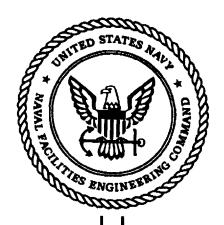


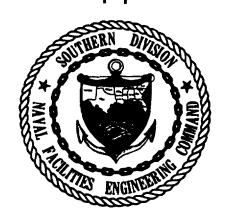
FINAL



CONTAMINATION ASSESSMENT PLAN HEALTH AND SAFETY PLAN

PLUME DELINEATION DEFENSE SUPPLY POINT HANAHAN, SOUTH CAROLINA

MARCH 1992



SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND CHARLESTON, SOUTH CAROLINA 29411-0068

RELEASE OF THIS DOCUMENT REQUIRES PRIOR NOTIFICATION OF THE COMMANDING OFFICER OF THE DEFENSE FUEL SUPPLY POINT, HANAHAN, SOUTH CAROLINA

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CONTAMINATION ASSESSMENT PLAN

PLUME DELINEATION DEFENSE FUEL SUPPLY POINT HANAHAN, SOUTH CAROLINA

CTO NO.: 00010

CONTRACT NO. N62467-89-D-0317

Prepared by:

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March 1992

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ACRONYMS, INITIALISMS AND ABBREVIATIONS

ABB-ES ABB Environmental Services, Inc.

BETX benzene, ethyl benzene, toluene, xylenes

bls below land surface

CA Contamination Assessment
CAP Contamination Assessment Plan
CARs Contamination Assessment Reports

cm/sec centimeters per second
DFSP Defense Fuel Supply Point

EIC Engineer-in-Charge

FID flame ionization detector

ft/day feet per day

ft²/day square feet per day GC gas chromatograph gpm gallons per minute

MOPs Monitoring Only Proposals

msl mean sea level

NOFAPs No Further Action Proposals

OVA organic vapor analyzer

PRAPs Preliminary Remedial Action Plans

PVC polyvinyl chloride

SCDHEC South Carolina Department of Health and Environmental Control

SOUTHNAV-

FACENGCOM Naval Facilities Engineering Command, Southern Division

USAEHA U.S. Army Environmental Hygiene Agency USEPA U.S. Environmental Protection Agency

USGS U.S. Geological Survey

1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), was contracted by the Naval Facilities Engineering Command, South Division (SOUTHNAVFACENGCOM) to prepare a Contamination Assessment Plan (CAP) for the Defense Fuel Supply Point (DFSP), Hanahan, South Carolina. The purpose of the CAP is to outline a field investigation and sampling program that will assess the source and extent of petroleum contamination along the eastern and western boundaries of the site. The investigation and subsequent report will be presented by SOUTHNAVFACENGCOM to the South Carolina Department of Health and Environmental Control (SCDHEC) for review. The following report presents the site location, summarizes previous investigations, and develops the rationale for the proposed monitoring plan to be implemented under the Contamination Assessment (CA).

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2.0 BACKGROUND

2.1 SITE DESCRIPTION. The DFSP site is located approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina (Figure 1). The site occupies approximately 36 acres just east of North Rhett Avenue. Immediately north of the DFSP facility is a residential community called Gold Cup Springs Subdivision (Figure 2). The areas to the west and south of the site are comprised mainly of light industry. Immediately east of the site is a U.S. Army-Navy Reservation. The facility contains seven, 70,000-barrel capacity, aboveground storage tanks, truck loading stands, and several buildings. Each tank is constructed of welded steel with a floating roof and is surrounded by an earthen berm. The primary product handled at the facility is JP-4 jet turbine fuel.

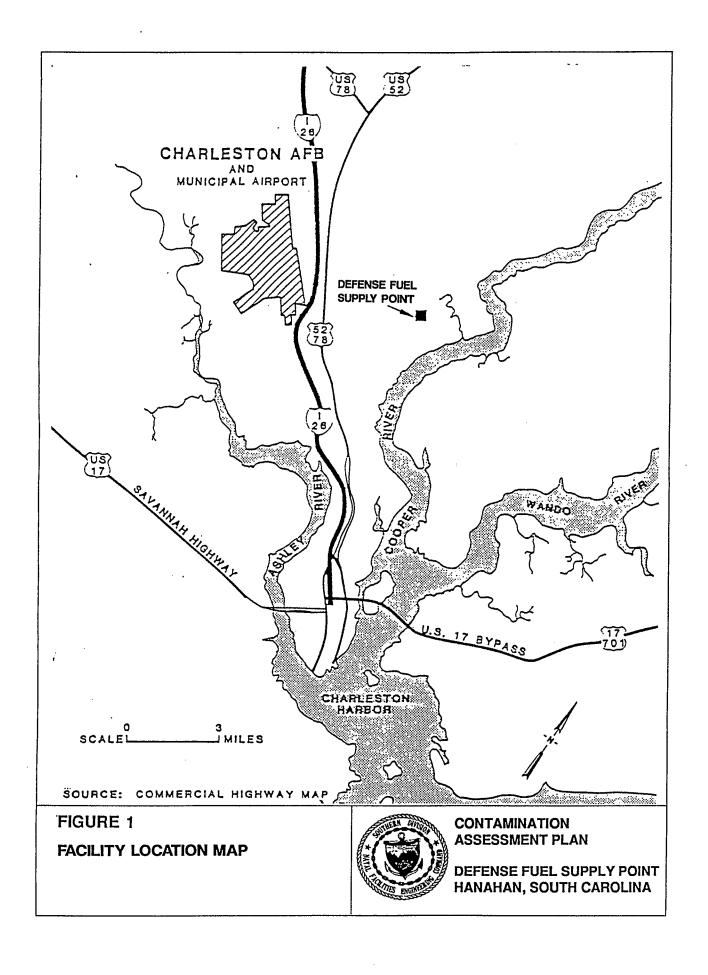
The DFSP facility is owned and operated by the Defense Logistics Agency, Alexandria, Virginia, and the facility property is owned by the U.S. Air Force. Environmental investigations and remedial activities at the site are being performed by SOUTHNAVFACENGCOM.

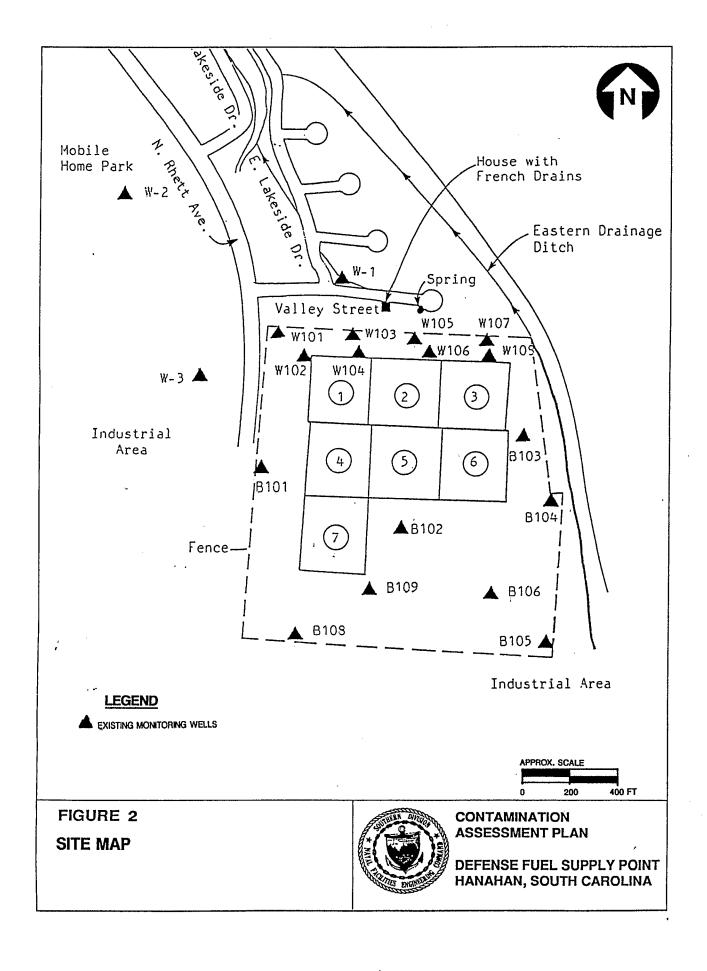
2.2 SITE HISTORY. In September 1975, a leak developed in the bottom of storage tank No. 1 immediately after it had been cleaned and put back in service. Approximately 83,000 gallons of JP-4 jet fuel were lost before a water bottom was put in the tank. Leakage was confirmed to be the cause of the loss. The lost fuel reached the shallow, surficial aquifer and migrated northward into the Gold Cup Springs Subdivision, a subdivision of approximately 75 homes.

In November 1975, the U.S. Army Environmental Hygiene Agency (USAEHA) from Aberdeen Proving Ground, Maryland, was brought in to investigate the site. Monitoring wells were installed to delineate the contamination and a well point system was constructed in December 1975 to extract the fuel from the groundwater and soils. The well point system became impractical by January 1976. A collection ditch was built along the northern border of the site to collect the remaining fuel. A second well point system was installed in March 1976 and was operated until April 1976. It was estimated that approximately 25 percent of the lost fuel was recovered by these operations.

In June 1980, the Defense Fuel Support Center (DFSC) contracted Dames and Moore to conduct a field investigation and monitoring program to assess the extent of groundwater contamination at the DFSP facility and in the Gold Cup Springs Subdivision, north of the facility. Dames and Moore installed 17 monitoring wells and collected groundwater samples from these wells for pH, specific conductance, total organic carbon, oil and grease, and diethylene glycol monomethyl ether (a fuel system icing inhibitor) analyses. The study concluded that hydrocarbon-related contamination was present in minimal amounts and was dispersed around the site. Past fuel recovery, chemical and biological processes, and natural dilution had reduced groundwater contamination.

In 1985, samples from additional monitoring wells installed by Science Applications International Corporation and sampled by General Engineering Laboratories, revealed JP-4-related compounds, including benzene, ethyl benzene, toluene, and xylenes (BETX) in an off-site wells. In additional studies conducted by McClelland Engineers, Inc., in 1986 and RMT, Inc., in 1987, JP-4-





related compounds were detected in the groundwater, surface water, soil, and sediment within the Gold Cup Springs Subdivision. In addition, air monitoring studies conducted by RMT, Inc., in 1987 identified some contamination of the air in subdivision homes and throughout the neighborhood.

In October 1987, ICF-Clements Associates, Inc., prepared a Risk Assessment for the DFSP facility. The results were that inhalation and ingestion of contamination associated with the facility, most notably benzene, could pose a potential cancer risk of greater than 1 in 1 million and that exposure to chemicals, while swimming in pools filled with contaminated groundwater, may result in significant risk. Exposure to noncarcinogens (most notably total xylenes) may also result in a hazard index greater than 1.

As a result of the investigations at the site, bioremediation was selected as the cleanup technique. The U.S. Geological Survey (USGS) is currently operating and monitoring the bioremediation system at the site.

In addition to the 83,000-gallon fuel leak at tank No. 1, other areas of the facility have been found to be contaminated with petroleum hydrocarbons. Small spills and leaks are the likely contributors of contamination in these areas. The USGS performed an initial site screening of the site using a passive soil gas survey in 1990. The USGS report (1991) concludes that an assessment of contamination delineation should be performed along the eastern and western parts of the facility.

2.3 HYDROGEOLOGY

2.3.1 Regional Hydrogeology The Charleston, South Carolina, area is underlain by four water bearing zones. These zones include the surficial water table aquifer, the Tertiary Aquifer System, the Black Creek Aquifer, and the Middendorf Aquifer.

The Coastal Plain of South Carolina, which includes Charleston, consists of a series of complex, interbedded unconsolidated to partially consolidated sedimentary formations of Late Cretaceous to Quaternary age. Surficial sediments within the study area consist of a variable sequence of sand, silt, and clay with a basal conglomeratic layer containing phosphate nodules that are a part of the Ladson Formation. The formation averages about 30 feet in thickness. These sediments were deposited as a result of a series of sea level encroachments and recessions that occurred during the Pleistocene epoch (Siple, 1946.)

The surficial water table aquifer is contained within the unconsolidated sediments of the Ladson Formation. The aquifer is recharged largely by the infiltration of precipitation over the area. Locally, the aquifer may be recharged by seepage from the underlying Santee Limestone in areas where the Cooper Formation is absent. Discharge from the surficial aquifer occurs principally by evapotranspiration and through natural seepage to surface water bodies. Shallow wells account for only a small amount of discharge from this aquifer and vertical migration into underlying aquifers is limited by the Cooper Formation. Depth to the water table of the surficial aquifer ranges from 3 to 15 feet below land surface (bls) and generally reflects changes in the local topography. Well yields average approximately 85 gallons per minute (gpm) with reported transmissivities between 600 and 1,340 feet squared per day (ft²/day)

(Park, 1985). The groundwater is commonly acidic and may contain high iron concentrations.

Unconformably underlying the Ladson Formation and forming the lower confining unit of the surficial aquifer and upper confining unit of the Tertiary Aquifer System is the Cooper Formation of Oligocene age. The Cooper Formation is a massive sandy, phosphatic limestone that is uniform in color and texture. The Cooper Formation requires only a few feet of thickness to effectively retard vertical groundwater flow.

Underlying the Cooper Formation and comprising the Tertiary Aquifer System are the Santee Limestone of Eocene age and the Black Mingo Formation of Paleocene age. The Santee Limestone consists of a creamy-white to gray, slightly glauconitic lime mudstone to marl. The unit ranges from 60 to 80 feet thick in the project area (Park, 1985). Wells tapping this unit yield between 200 and 500 gpm and are mostly under artesian conditions. The Tertiary Aquifer System is recharged by infiltration in updip outcrop zones inland of the project area. Groundwater flow in the aquifer is to the southeast under relatively flat regional hydraulic gradients (Aucott and Speiran, 1985). Excessive hardness and high iron and fluoride concentrations are common in the groundwater of the Santee Limestone. Brackish water can be found at the coastal margin of Charleston County.

The Black Mingo Formation underlies the Santee Limestone and is composed of limestone, green to gray argillaceous sand, and dark-gray to black clay. This formation is approximately 400 feet thick in the project area (Park, 1985). This formation is hydraulically connected to the Santee Limestone and is the lowest unit of the Tertiary Aquifer System. The sands of the Black Mingo Formation constitute the major water-bearing strata. Well yields average approximately 230 gpm. Transmissivities in this unit range from 500 to 3,700 square feet per day (ft²/day) and hydraulic conductivities range between 29 to 170 ft/day (Park, 1985).

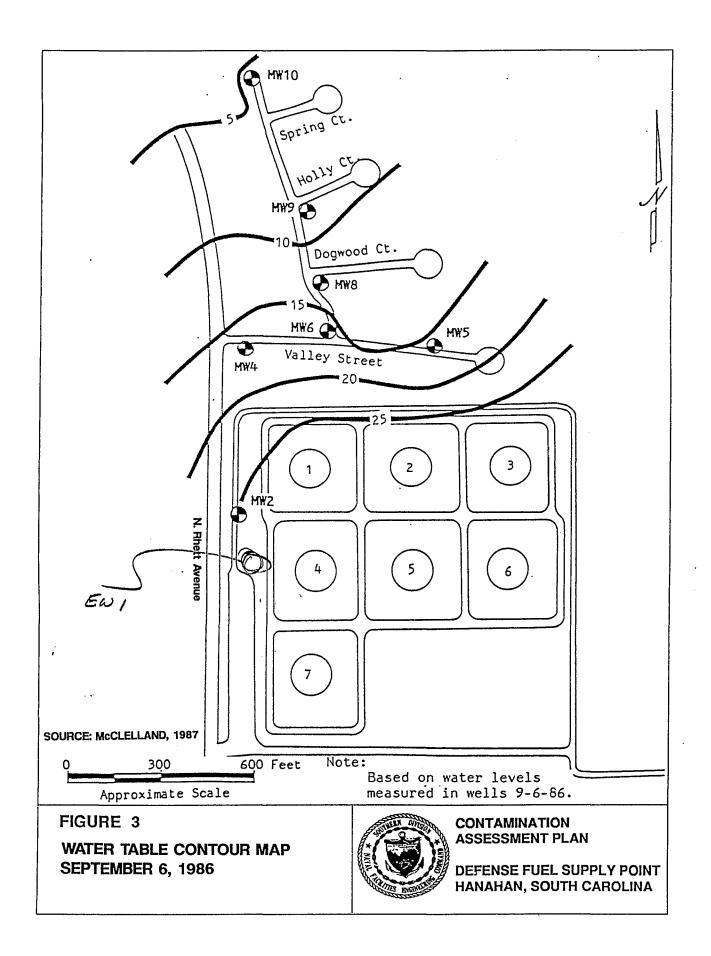
Underlying the Black Mingo Formation approximately 700 feet below mean sea level (msl) are the Peedee, Black Creek, and Middendorf Formations of Late Cretaceous age. These formations consist of interbedded sand, silt, and clay with occasional limestone. Each of these formations is capable of producing groundwater under artesian pressure; however, the major water bearing zones are the Black Creek Aquifer in the Black Creek Formation and the Middendorf Aquifer in the Middendorf Formation.

The lower part of the Black Mingo Formation and the Peedee Formation contains sufficient clays and silts to form an effective vertical hydraulic barrier between the upper Tertiary Aquifer System and the lower Black Creek Aquifer. Another confining unit exists in the lower Black Creek Formation and upper Middendorf Formation to separate the Black Creek Aquifer from the Middendorf Aquifer. Hydraulic conductivity in the Black Creek Aquifer has been estimated at 2 to 59 ft/day with a storage coefficient of 10⁴ (Park, 1985). Groundwater flow direction in the Black Creek Aquifer is to the east. The Middendorf Aquifer is the most productive of the two aquifers with groundwater flow to the east-northeast under a gentle regional hydraulic gradient (Aucott and Speiran, 1985). Both aquifers contain potable water; however, in some areas water quality may have excessive concentrations of dissolved sodium, bicarbonate, and fluoride.

The basement rock in the region is Triassic in age and occurs approximately 3,000 feet below msl (Park, 1985).

2.3.2 Site Hydrogeology Soil boring and monitoring well data from previous studies indicate that the DFSP site is underlain by 25 to 38 feet of recent fill and fine sands with numerous clay and silt lenses and basal layers of phosphatic gravels of the Ladson Formation. This formation thins towards the north. The surficial aquifer is contained in these materials. Beneath the Ladson Formation and forming the base of the surficial aquifer is the homogeneous, dark green-gray calcareous clay and silt (marl) of the Cooper Formation. This formation is estimated to be 260 feet thick in this area and presents a very competent confining layer in the site area (Dames and Moore, 1982). The contact between the Ladson and Cooper Formations is undulatory and varies between 1 and 8 feet above msl. Depth to the surficial aquifer water table ranged from 5 to 18 feet bls during previous investigations. Some of this variability is based on surface elevations; however, the data suggests that the water table fluctuated by as much as 7 feet at the site.

The general direction of groundwater flow in the surficial aquifer at the site is to the north-northwest. Localized groundwater flow directions at the site may be controlled by topography, with groundwater flow west of the DFSP site toward the west and groundwater flow just north of the DFSP site generally towards the centerline of the north-south valley through which East Lakeside Drive runs. Figure 3 illustrates a water table contour map from data collected on September 6, 1986. Calculations for hydraulic conductivity from monitoring wells at the site using the Hvorslev (1951) method range from 10⁻⁴ to 10⁻³ centimeters per second (cm/sec). An estimated seepage velocity at the DFSP site was calculated as 8.5x10-5 cm/sec or 0.24 ft/day using an average hydraulic conductivity of 8.5x10 cm/sec, an average hydraulic gradient of 0.02, and an effective porosity of 0.20 (McClelland Engineers, 1987). It is believed that the discharge of groundwater by the numerous springs in the Gold Cup Springs Lake neighborhood into the ditch on E. Lakeside Drive, along with the routing of groundwater discharges by French drains installed by several residents on Valley Street, may significantly increase the rate of contaminant transport.



3.0 PROPOSED ASSESSMENT PLAN

It is proposed that a two-phase field investigation be undertaken to assess the suspected contaminant plumes at the DFSP site. The phased approach is discussed in the following two sections. During both the Phase I and Phase II field investigations, the ABB-ES field leader will meet onsite or at SOUTHNAVFACENGCOM with the SOUTHNAVFACENGCOM Engineer-In-Charge (EIC) on a weekly basis to discuss the field investigation progress and findings. The Phase I and Phase II investigations will proceed with no stoppage of work between the phases.

3.1 PHASE I FIELD INVESTIGATION. The purpose of the Phase I investigations is to assess the approximate horizontal extent of the contaminant plumes in the areas where concentrations of petroleum contaminants are considered to be highest. This will be accomplished by obtaining groundwater samples from temporary wellpoints and soil samples from hand augered soil borings and screening the groundwater samples with a field gas chromatograph (GC) and the soil samples using an organic vapor analyzer (OVA). The information obtained during this field screening phase will assess the extent of the contaminant plumes and direct the placement of monitoring wells during the Phase II investigation.

Prior to the Phase I investigation, any necessary permits, off-site utility clearances, and right-of-way easements and private property access approvals will be obtained with the help of Navy personnel or their representatives. In addition, information on the location of potable water wells within a 1/4-mile radius of the site will be obtained from SOUTHNAVFACENGCOM, DFSP, SCDHEC, and previous investigation reports.

The Phase I field investigation will consist of installing as many as 37 temporary wellpoints along the western side of the DFSP site to assess the western contaminant plume. As many as 27 temporary wellpoints will be installed to assess the eastern and southern contaminant plume. As many as 10 temporary wellpoints will be installed to assess the contaminant plume identified southeast of tank 2 and extending along the eastern side of tank 5. The locations of the proposed temporary wellpoints are shown on Figure 4. ABB-ES proposes an additional 10 wellpoints be installed at the discretion of the field leader as dictated by the field GC results to further assess the contaminant plumes. These 10 wellpoints are not depicted on Figure 4.

The wellpoints will be installed using a KV Macho System™ or equivalent. The system consist of 3/4-inch outside diameter slotted, hollow, stainless-steel rods that are driven to below the water table using a vibratory hammer. Groundwater samples are withdrawn through the rod using a peristaltic pump.

Groundwater samples will be collected at each wellpoint location and screened for the presence of the petroleum contamination constituents BETX using a field GC. In addition, as many as 20 shallow soil borings will be conducted using a hand auger where possible at both the southern, eastern and western contaminated areas and the areas near tanks 2 and 5. Each soil boring will be advanced to a maximum depth of 9 feet bls or until groundwater is encountered. Three soil samples will be collected from each boring, one soil sample from each 3-foot interval beginning at the ground surface. These samples will be collected in each

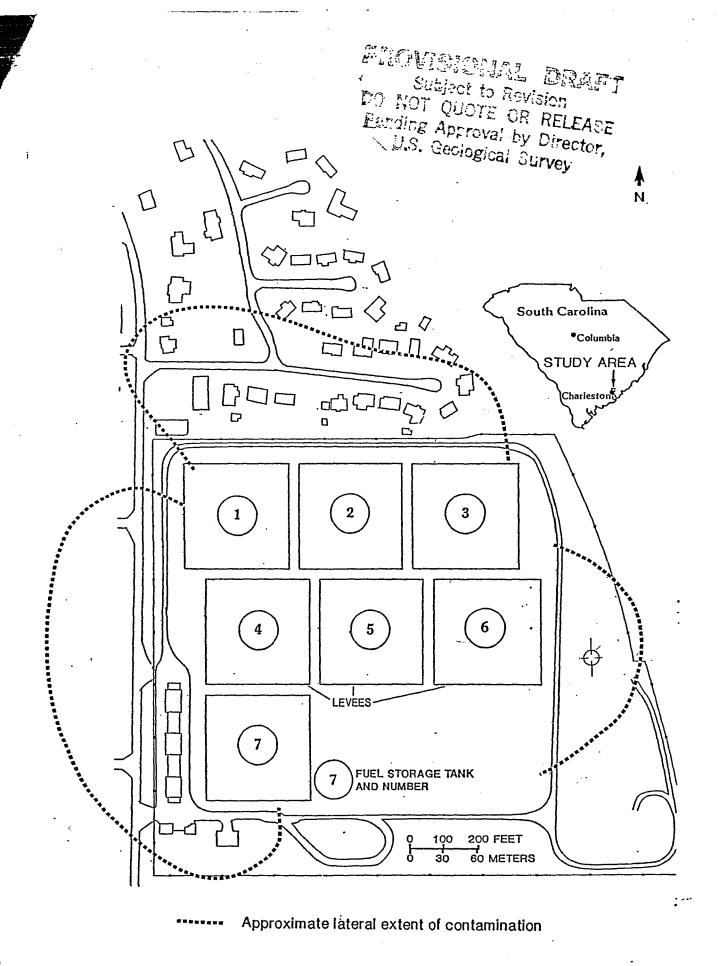
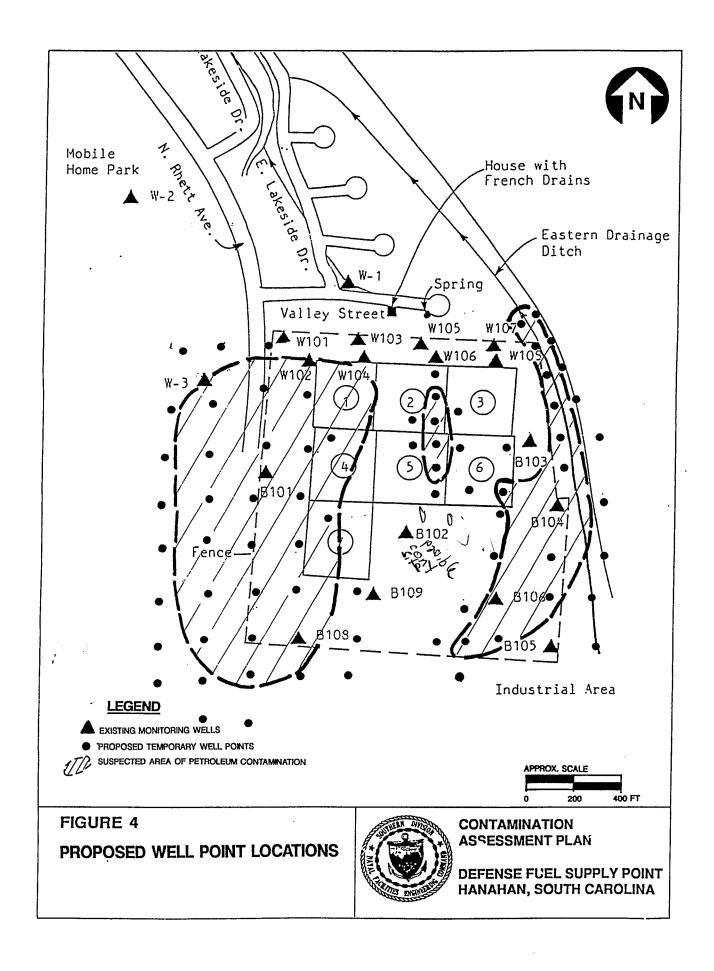


Figure 1.—Approximate lateral extent of contamination of all known plumes at the DFSP facility, November 1989 (RMT,Inc.,1990).



interval at the discretion of the field leader. Soil samples will be used to assess soil contamination and to describe the site-specific lithology. Soils will be classified in accordance with the Unified Soil Classification System. Soil samples for contaminant screening will be collected from each soil boring and placed in 16-ounce glass jars. The soil samples will be screened for petroleum contamination by head space analysis using an OVA equipped with a flame ionization detector (FID).

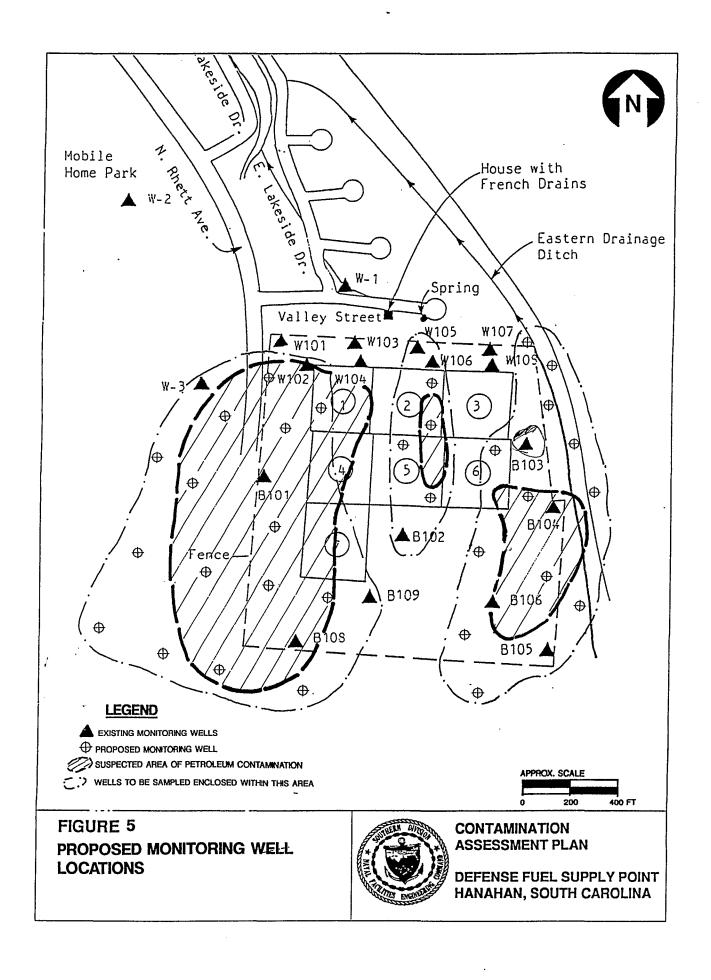
3.2 PHASE II FIELD INVESTIGATION. The purpose of the Phase II field investigation is to further assess the horizontal extent of the petroleum contamination in the southern, eastern, and western areas and the area near tanks 2 and 5 of the DFSP facility, assess the vertical extent of the petroleum contamination, and characterize the contamination. This will be accomplished through the drilling of soil borings in areas where hand augering could not take place to collect soil samples for OVA screening, the installation of permanent groundwater monitoring wells, the collection of groundwater samples from the monitoring wells for laboratory analysis of jet fuel constituents, surveying of the elevations of the monitoring wells to determine aquifer flow direction and gradient, and aquifer testing on select monitoring wells to estimate aquifer characteristics.

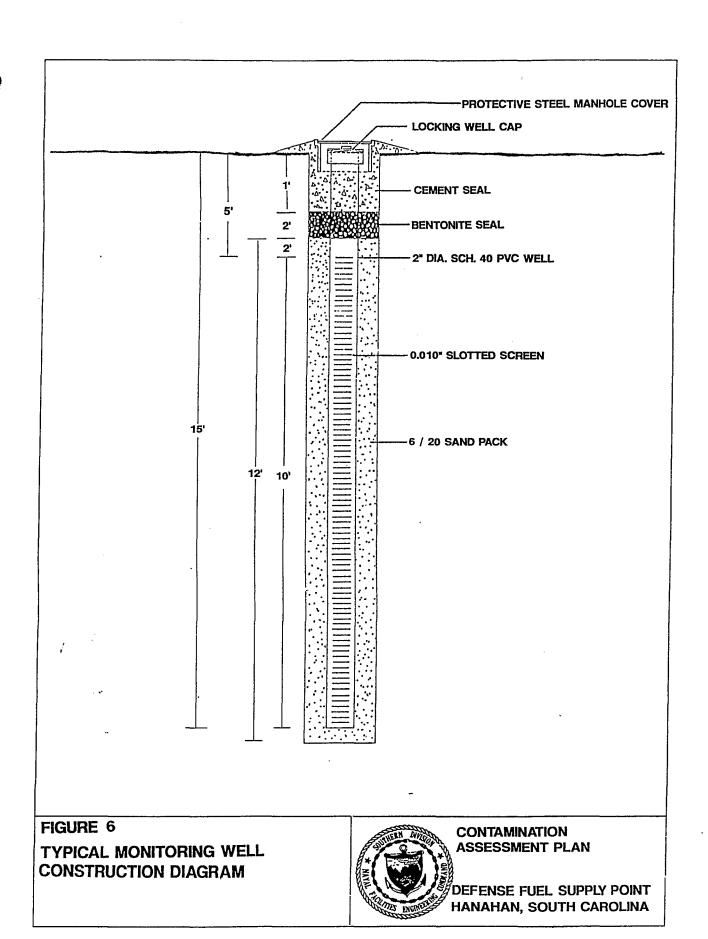
During the Phase II field investigation, 31 shallow monitoring wells (approximately 15 feet in depth) will be installed at the site to assess the contaminant plumes. The location of the proposed monitoring wells is shown on Figure 5; however, exact well placement will depend on the results of the Phase I investigation. All monitoring wells will be constructed of 2-inch inside diameter, flush threaded Schedule 40 polyvinyl chloride (PVC) screen and riser. The well screen will be comprised of a 10 foot section of 0.010-inch slotted screen. Well screens will be set such that a minimum of 2 feet of screen will be above the water table. Depth to the water table in existing wells will be measured to determine the depth interval for the well screen. The remainder of the well casing will consist of solid riser pipe to the ground surface. Total well length and depth for the shallow monitoring wells is not expected to exceed 15 feet bls.

The well annulus will be filter packed with No. 6-20 sand or an acceptable grade of sand to at least 1 foot above the well screen. A 2-foot bentonite seal will be placed above the sand pack with the remaining annular space grouted to the surface. Wells will be flush mounted with the ground surface and will consist of a locking protective cap and a steel subsurface vault set in the pavement around each well riser pipe. Typical construction details for the proposed monitoring wells are provided in Figure 6.

In addition to the monitoring wells, as many as 15 shallow soil borings will be advanced with a drill rig in those areas where it was not possible to perform the Phase I manual soil borings. Soil samples will be collected as described above and used for the same purposes.

Upon completion of the monitoring well installation, the wells will be developed using a centrifugal pump until the groundwater is sediment free or as clear as the aquifer will allow in a reasonable amount of time. The measuring point for groundwater elevation on the PVC riser pipe and the land surface adjacent to each monitoring well will be surveyed to within \pm 0.01 foot based on an arbitrary reference elevation of 50 feet.





Groundwater samples will be collected from the newly installed monitoring wells in addition to 12 existing wells (W-3, W102, W105, W106, B101 through B106, B108, and B109) at the site and analyzed for jet fuel constituents (U.S. Environmental Protection Agency (USEPA) Methods 602, 610, 239.2, and 8015 [extraction method 3510]). At the western contamination area, 20 groundwater samples will be collected; at the eastern and southern areas, 16 groundwater samples will be collected; and in the area near tanks 2 and 5, 7 groundwater samples will be collected. In addition, four duplicate samples, two equipment blanks, one field blank, and five trip blanks will be obtained.

Groundwater samples will be shipped via overnight carrier to an approved analytical laboratory. Sampling and the subsequent analytical program will comply with the ABB-ES' Comprehensive Quality Assurance Plan (ComQAP).

During the Phase I and II field investigations, ABB-ES personnel and their subcontractors will coordinate efforts with site personnel to dispose of contaminated fluids and soils. ABB-ES and their subcontractors will place any contaminated soils on plastic sheeting in an area approved by the facility manager. The soils will be encircled within a bermed area. The contaminated soil will be laid out in 6-inch deep layers on the plastic sheeting. The soils will be covered with plastic sheeting to prevent rainstorms from washing the soils away. At the time when remedial efforts are undertaken the soils will be disposed. Any contaminated fluids will be transported and deposited in a train tanker car that is kept at the facility for the purpose of disposal of waste fluids. It will be the Navy's responsibility to dispose of any hazardous waste that may be generated during this project.

3.3 PREPARATION OF REPORTS. Upon completion of the field investigations and receipt of the analytical laboratory results of the groundwater samples, draft, 100 percent complete, and final Contamination Assessment Reports (CARs) will be prepared and submitted to SOUTHNAVFACENGCOM and the Naval activity for review and approval. The reports will discuss site background information, site conditions, findings, and recommendations for the investigated areas of the DFSP site. Recommendations shall be made as to the need for any follow-up reports. Site location maps; locations of soil borings, wellpoints, and monitoring wells; groundwater contour maps; and contamination delineation maps will be included with the reports.

Based on the findings, conclusions, and recommendations of the final CAR, draft, 90 percent complete, 100 percent complete, and final follow-up reports will be prepared for the investigated areas of the DFSP site. The reports shall be either No Further Action Proposals (NOFAPs), Monitoring Only Proposals (MOPs), or Preliminary Remedial Action Plans (PRAPs).

If a PRAP is developed for the DFSP site it will include the following items:

- summary sheet of the CAR;
- general discussion of the technical and economic feasibility of remedial alternatives and more detailed information on the most feasible remedial system;
- general discussion of the rationale of the selected system;

- comparison of contaminant levels found with existing State and USEPA cleanup criteria in tabular format;
- disposition and expected contamination concentrations in any effluent from the proposed cleanup method;
- cost estimates and schedules for the design, construction, startup, and operational phases of remediation;
- designation of monitoring wells and proposed methodology for verifying accomplishment of PRAP goals (cleanup levels);
- details of any proposed treatment of contaminated soils;
- design and construction details;
- schedule for completion of the remedial action; and
- · recommendations for conducting pilot studies and obtaining additional information.

Additional site information that may be needed to develop the performance specifications but not included in this scope is as follows:

- · horizontal and vertical survey data,
- · locations of existing utilities, and
- · location and availability of electric power.

4.0 SCHEDULE

A projected schedule to complete the Contamination Assessment field investigation is approximately 9 weeks. The field investigation is tentatively scheduled to begin the week of May 11, 1992. Upon completion of the field investigation, approximately 3 weeks will be required before receipt of the laboratory analyses of the groundwater samples that were collected during the investigation. A draft CAR will be prepared and submitted to SOUTHNAVENGCOM by August 6, 1992. If proper time schedules for report review are followed, a draft follow-up report has been scheduled to be delivered to SOUTHNAVFACENGCOM by October 13, 1992. A Gantt Chart outlining the project schedule is presented as Figure 7.

Task Name SCHEDULE	Start Date	End Duratn Date (Days)		
DFSP HANAHAN FIELD S.C.	15-Apr-91 15-Apr-91	12-Feb-93 462 12-Feb-93 462		
HANAHAN HASP & CAP	15-Apr-91 15-Apr-91 15-Apr-91	20-Mar-92 235 6-Feb-92 205	######################################	
PREPARE DRAFT HASP, QAP,& CAP	15-Apr-91 15-Apr-91	29-Apr-91 10 29-Apr-91 10		
SUBMIT DRFT HASP, CAP AND QAP	29-Apr-91 29-Apr-91	29-Apr-91 0 29-Apr-91 0		
NAVY REVIEW DRFT HASP; CAP, &QAP		7-May-91 '6 7-May-91 6		
PREPARE FINL DRFT HASP, CAP, QAP		17-May-91 8 17-May-91 8		
SUBMIT FINL DRFT HASP, CAP, &QAP		17-May-91 0 17-May-91 0		
NAVY REVIEW DRFT FINL HASP, ETC		18-Jun-91 20 18-Jun-91 20		
S CAROLINA REG AGENCY DELAY	18-Jun-91 18-Jun-91	8-Jan-92 139 8-Jan-92 139		
WAIT FOR RESPONSE FROM S.C.		8-Jan-92 139 8-Jan-92 139	000000000000000000000000000000000000000	
RCVD COMMENTS FROM S.C.(FAX)		8-Jan-92 0 8-Jan-92 0		
PREPARE FINAL HASP, CAP, & QAP	9-Jan-92 9-Jan-92	20-Mar-92 50 6-Feb-92 20	eestessess.	
SUBMIT FINAL HASP, CAP, & QAP	20-Mar-92 6-Feb-92	20-Mar-92 0 6-Feb-92 0		
HANAHAN FIELD INVESTIGATION	11-May-92	30-Jun-92 35		
LABORATORY ANALYSIS	30-Jun-92 30-Jun-92	22-Jul-92 15		
HANAHAN CAR	23-Jul-92 23-Jul-92	20-Nov-92 84		
PREPARE DRAFT CAR	23-Jul-92 23-Jul-92	6-Aug-92 10 6-Aug-92 10	000	
SUBMIT DRAFT CAR TO NAVY	6-Aug-92	6-Aug-92 0	LEGE	
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PREPARE DRAFT FINAL CAR	7-Aug-92 8-Sep-92	4-Sep-92 20 29-Sep-92 15	(Slack) == (Sl Progress shows Percent Achieved	ack)
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HANAHAN PRAP	8-Sep-92	20-Nov-92 0 12-Feb-93 108		
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SITE-SPECIFIC HEALTH AND SAFETY PLAN FOR CONTAMINATION ASSESSMENT INVESTIGATION

DEFENSE FUEL SUPPLY POINT HANAHAN, SOUTH CAROLINA

CTO NO.: 00010

Contract Number N62467-89-D-0317

Prepared by:

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MARCH 1992

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REFERENCES

The following chapters of the Comprehensive Long-term Environmental Action Navy (CLEAN) Program District I Generic HASP are applicable for the work anticipated at the site:

<u>/</u> 2.0	AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL
<u>/</u> 3.0	TRAINING PROGRAM
<u>/</u> 4.0	MEDICAL SURVEILLANCE PROGRAM
<u>/</u> 5.0	ENGINEERING CONTROLS
<u>√</u> 6.0	PERSONAL PROTECTIVE LEVEL DETERMINATION
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1.0 GENERAL

1.1 SCOPE AND PURPOSE. This Health and Safety Plan (HASP) has been prepared in conformance with the Navy CLEAN Program District I (CLEAN) HASP and is intended to meet the requirements of 29 Code of Federal Regulations (CFR) 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all ABB-ES personnel, contractor personnel, or third parties entering the site.

1.2 PROJECT PERSONNEL.

- 1.2.1 Project Manager The project manager (PM) is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP, the necessary resources to meet requirements of this HASP, the coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements, and the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project.
- 1.2.2 General Site Supervisor The General Site Supervisor is either the PM or the PM's designee who is on-site and vested with the authority by the PM to carry out day-to-day site operations, including interfacing with the site Health and Safety Officer (HSO).
- 1.2.3 Health and Safety Officer The HSO for this project has been designated by the PM with concurrence of the Health and Safety Supervisor (HSS) or Health and Safety Manager (HSM). The HSO will have at least an indirect line of reporting to the HSM through the HSS for the duration of his/her assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the CLEAN HASP. The HSO will investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting an ABB-ES site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.
- 1.3 TRAINING. Training is defined under the CLEAN HASP, and all personnel entering potentially contaminated areas of this site must meet the requirements of 29 CFR 1910.120. Personnel without the required training will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 3.0 of the CLEAN HASP for further information.

1.4 MEDICAL SURVEILLANCE. All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the CLEAN HASP. Personnel who have not received medical clearance will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 4.0 of the CLEAN HASP for further information.

2.0 SITE CHARACTERIZATION AND ANALYSIS

- 2.1 SITE NAME, LOCATION, AND SIZE. The Defense Fuel Supply Point (DFSP) site is located just east of North Rhett Boulevard approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina. The facility occupies approximately 48 acres.
- 2.2 SITE HISTORY AND LAYOUT. In September 1975, a leak developed in the bottom of one of seven 70,000 barrel capacity aboveground storage tanks. Approximately 83,000 gallons of JP-4 jet fuel was lost. The initial recovery operation recovered approximately 25 percent of the lost fuel. This leak occurred along the northern boundary of the property. Subsequent investigations from 1979 to 1990 indicated that petroleum contaminant plumes may exist along the eastern and western boundaries of the facility as a result of past spills and leaks.
- 2.3 SCOPE OF WORK (WORK PLAN). ABB-ES will conduct a contamination assessment along the eastern and western boundaries of the facility. The assessment will include shallow soil borings, collection of groundwater samples from temporary wellpoints, and the installation and sampling of permanent monitoring wells. The work will be conducted in Level D protective wear.

3.0 TASK ANALYSIS

3.1 TASK ONE.

- 3.1.1 <u>Hazardous Substances</u> The contaminants of concern known or suspected to be present on-site, along with any established exposure limits for those substances are listed in Table 3-1.
- 3.1.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered at the site.
- 3.1.2.1 Health Hazards Contaminants to which personnel may be exposed are gasoline and diesel fuel and their constituents. The primary constituents of gasoline and diesel fuel that represent potential health hazards are described below and summarized in Table 3-1.

BENZENE is a watery, colorless liquid with a pleasant aromatic odor. It is a moderate irritant in small amounts both as a gas and as a liquid. If inhaled in large amounts it attacks the central nervous system, possibly resulting in coma and/or respiratory arrest. Chronic poisoning causes leukemia.

ETHYL BENZENE is a colorless aromatic liquid. It is a moderate skin irritant in gaseous form. Inhalation of high concentrations of the gas may cause temporary irritation of the nose, dizziness, and depression. The liquid form can blister the skin if not washed off immediately.

TOLUENE is a watery, colorless liquid with a pleasant aromatic odor. It is a mild skin irritant. Inhalation of high concentrations of the gas can cause temporary smarting of the eyes or irritation of the respiratory system. If the liquid form is allowed to remain on the skin for a long period of time, smarting and reddening of the skin may occur. Ingestion or aspiration of the liquid causes depressed respiration and pulmonary edema, and can result in kidney or liver damage.

XYLENE is a colorless, watery liquid with a sweet odor. It is a moderate skin irritant. When present as a gas in high concentrations, it can cause temporary slight smarting of the eyes or irritation of the respiratory system, headache, and dizziness. The liquid form may cause smarting or reddening of the skin if not washed off immediately. If the liquid is aspirated into the lungs it can result in severe coughing, distress, and rapidly developing pulmonary edema. If ingested, nausea, vomiting, cramps, headache, and coma can occur and may be fatal. Ingestion may also result in kidney and liver damage.

POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs), for the purposes of this plan and study, include those listed as parameters for USEPA Method 610. Some of the more notable PAHs from this method include acenaphthene, anthracene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene.

Table 3-1 Contaminants of Concern

Health and Safety Plan Defense Fuel Supply Point Hanahan, South Carolina

Chemical	Approximate odor threshold (ppm)	Permissible Exposure Limits (ppm)	Threshold Limit Value (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Benzene	4.7	1	1	Colorless liquid, pleasant aromatic odor.	Moderate skin irritant.	Inhalation of large amounts at- tacks central nervous system (CNS); chronic poisoning causes leukemia.
Ethyl benzene	140	100	100	Colorless liquid, aromatic odor.	Moderate skin irri- tant.	Liquid blisters skin, inhalation results in dizziness, depression.
Toluene	0.17	100	100	Colorless liquid, pleasant aromatic odor.	Mild skin irritant.	Ingestion or aspiration can cause pulmonary edema, depressed respiration.
Xylene	0.05	100	100	Colorless liquid, aromatic odor.	Moderate skin irri- tant.	Inhalation causes headache and dizziness; vapors irritate eyes; can be fatal if ingested.
Naphthalene		10	10	Colorless to brown solid with an odor of mothballs	Moderate skin irritant	Inhalation causes headache and confusion; vapors irritate eyes.
Lead				Soft, ductile, gray, metal, soluble in water containing a weak acid.		Lead poisoning may cause fa- tigue, anemia, abdominal pains, and neurological damage.

Notes: ppm = parts per million.

In addition, care will be taken to avoid contact with the base neutral compounds that include naphthalene, phenanthrene, fluorene, and anthracene. Details of these compounds are listed in Section 4.0.

All activities at this site will be conducted in unconfined areas. This will minimize the chances of exposure of on-site personnel to either high vapor concentrations or strong liquid concentrations of any of the substances described above.

3.1.2.2 Safety Hazards Safety hazards include those hazards which personnel may be exposed to that are unrelated to hazardous wastes. These include hazards such as heat stress, operation and presence around heavy equipment, lifting of objects, vehicle traffic, and snake bites. Extreme caution should be exhibited by all personnel while conducting work around drill rigs, backhoes, and other heavy equipment. During hot days, personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress.

Lifting of heavy objects should be done with caution. Personnel should assist one another with moving heavy objects or use the appropriate equipment to accomplish these tasks. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes.

Power substations, powerlines, underground utilities, and underground pipelines are to be avoided during drilling operations. Information on underground utilities and scheduling of the field work at the facility will be coordinated with Mr. Don Matthews, the Quality Assurance Supervisor at DFSP Hanahan.

- 3.1.2.3 Conclusions and Risk Assessment Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be <u>low</u>, assuming appropriate health and safety practices are maintained.
- 3.1.3 Protective Measures The following are the protective measures that will be used at the site.
- 3.1.3.1 Engineering Controls Whenever needed, engineering controls (i.e., fans to blow volatilized chemicals away from the work area) will be used.
- 3.1.3.2 Levels of Protection A level D work uniform will be used at the site. Level D Protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.
- 3.1.4 Monitoring It is intended that real time monitoring instrumentation will be used to monitor the work environment in order to ensure the appropriate level of protection for the site team.
- 3.1.4.1 Air Sampling To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

- 1. Foxboro Organic Vapor Analyzer Model 128 (OVA)
- If the OVA detects a steady measurable quantity of organic vapors greater than 5 ppm (above background conditions) in the breathing zone, the field team will withdraw from the site until health and safety conditions at the site are reevaluated.
- **3.1.4.2** Personal Monitoring Personal monitoring will be undertaken to characterize the personal exposure of high risk employees to the hazardous substances they may encounter on-site. Personal monitoring will be conducted on a representative basis. Personnel who are represented by the sampling will be noted in field logs.

The following personal monitoring equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the maintenance and calibration of the equipment.

1. Thermoluminescent Dosimetry Body Badge

Common Synonyms S.:20! Penzole	Watery kquid	Coloriess	Gasoline-like odor	6.1 6.2	6. FIRE HAZARDS Flash Point: 12°F C.C. Flammable Limits in Air: 1.3%-7.2%	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U-V-W
	Flosis on water, point is	Flammable, irritating vap 42°F.	or is produced. Freezing	6.3	Fire Extinguishing Agents: Dry chemical, foam, or carbon drowde Fire Extinguishing Agents Not to be	
Wear goggles and s Shut oft gridlen sou Stop discharge if po Stay upwind and ust Isolate and remove Notify local health a FLA Flas Vap Wear Eine Wite	water spray to "knock discharged material, and poliution control age MMABLE, these along vapor trail or may explose if ignite googles and sett-control opening and sett-control.	apparatus. ment. down" vapor. ncies. may occur. d in an enclosed area. insec breathing apparatus foam, or carbon dioxide fire.		6.5 6.6 6.7 6.8 6.9 6.10	Used: Water may be ineffective Special Hazards of Combustion Productar Not periment Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back Ignition Temperature: 1097'F Electrical Hazard: Class I, Group D Burning Rate: 6.0 mm/min. Adiabatic Flame Temperature: Data not available Stolchlomatric Air to Fuel Ratio: Data not available Flame Temperature: Data not available	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable Kould 11.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fre
VAP Intent If intent Move If Dec If the LIOI Intent Har Exposure Fire If the If Se	ing to eyes, nose and usited, will cause heads to flesh air strings has stopped, grathing is difficult, give of BID ling to skin and eyes, not if swallowed, over contaminated cight, affected areas with pie EYES, note eyeling on eyeling to grees the sking of the ski	che, difficult breathing, or re andicial respiration crygen.	of welet.	7.2 7.3 7.4 7.5 7.6 7.7	7. CHEMICAL REACTIVITY Reactivity With Water, No reaction Reactivity with Common Materials; No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not pertinent Polymerization: Not pertinent Inhibitor of Polymerization: Not pertinent Molar Ratio (Reactant to Product): Date not available Reactivity Group: 32	Aesthelic Effect. 3 Reactivity Other Chemicals 2 Water. 1 Self Reaction. 0 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue) 2 Flammabiliny (Red) 3 Reactivity (Yellow) 0
Water May	MFUL TO AQUATIC LI be dangerous if c enter local health and width operators of nearthy w	e officials.	ENTRATIONS.			12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 16°C and 1 atm: Liquid 12.2 Molecular Weight: 7E.11 12.3 Boiling Point at 1 atm: 176°F = 80.1°C = 253.3°K
RESPONSE TO (See Response Metho Issue warning-high t Restrict access	ds Handbook)	2. LABEL 2.1 Category: Flat 2.2 Class: 3	mmaDle liquid	1.2	8. WATER POLLUTION Aquatic Toxicity: 5 ppm/6 hr/minnow/lethal/distilled water 20 ppm/24 hr/sunlish/TLm/tap water Waterfowl Toxicity: Data not available Blological Oxygen Demand (BOD): 1,2 br/b, 10 days	12.4 Freezing Point: 42.0°F = 5.5°C = 276.7°K 12.5 Critical Temperature: 552.0°F = 265.9°C = 562.1°K 12.6 Critical Pressure: 710 psis = 46.3 atm = '4.89 MN/ms' 12.7 Specific Gravity: 0.676 at 20°C (Equid) 12.8 Liquid Surface Tension: 26.6 dynes/cm = 0.0289 N/m at 20°C
3. CHEMICAL DE 3.1 CG Compatibility Clas- Hydrocarbon 3.2 Formula: CsHs 3.3 IMO/UN Designation: 3.4 DOT 1D No.1 1114 3.5 CAS Registry No.2 71-	a: Aromatic 3.2/1114	4.1 Physical State 4.2 Color: Colories 4.3 Odor: Aromatic	BLE CHARACTERISTICS (as shipped): Liquid ss c, rather pleasant aromatic ictematic odor	5.4	Food Chain Concentration Potential: None	12.9 Liquid Water Interfacial Tenaion: 35.0 dynes/cm = 0.035 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 2.7 12.11 Ratio of Specific Heats of Vapor (Gas): 1.061 12.12 Latent Heat of Vaporization: 169 Btu//b = \$4.1 cal/g = 3.54 × 10 ³ J/kg 12.13 Heat of Combustion: —17,460 Btu//b = —9595 cal/g = —406 0 × 10 ³ J/kg
hydrocarbon-insolub hydrocarbon-insolub hydrocarbon-insolub yellowing headache, breathler Treatment of Expõeus contaminated clothis iNHALATION: remostopped, stari resus-5.4 Threshold Limit Valus-5.5 Short Term Inhalation	iquipment: Hydrocarbo le rubber or plastic gloo le apron such as neopr Exposure: Dzziness, sness, chest constriction er: SKIN: flush with was 19 and wash skin. EYE! re from exposure imme tration, administer oxy; 1: 10 ppm Llimite: 75 ppm for 30; Grade 3; LDss = 50; lia	excitation, pallor, followed m. Coms and possible of ter followed by soap and S: flush with plenty of war distely. Call a physician. I pen. D min. to 500 mg/kg ent in high concentrations	tace splash shield; I by flushing, weakness, path.	9.2	9. SHIPPING INFORMATION Grades of Purity: Industrial pure99+% Thiophene-free99+% Industrial 90%85+% Respent92+% Storape Temperature: Open Inert Atmosphere: No requirement Venting: Pressure-vacuum	12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.15 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 30.45 csl/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 3.22 psia
5.9 Liquid or Solid Irritar	t Characteristics; Mini marting and reddening ppm	mum hazard. If spilled on	cothing and allowed to		. но	TES
1						

Common Synor Phenylethane EB	н угле	Liquid	Coloriess	Sweet, gasoline-like odor
.p		Floats on water	. Flammable, irmating va	por is produced.
Shut off ign Stop dische Step upwind Isolate and	tiuding glove niori soutces ige il possib send use mi reniove disc	:s) : and cal! fire depi	ck down" vapor.	rciothing
Fire	Extruding Astronomy	ik along vapor trai av explode it ionin (including gloves).	et ig an enclosed atea. et foam, or carbon dioxi	and subber overclothing ide.
Exposure	VAPOR Immaino Il jinhailed Il breath Il breath LIOUID Wall burn Harmiul Flush at IF IN EY IF SWALL	to eyes, nose and throat, pell cause deziness or difficult breathing, no has stooped the eminoal respiration no is ordicult, one crypen, skin and eyes, swalloweduc clothing and shoes, cered shoes at premy of water. ES hold syeuts open and first with planty of water ICMED are worth is CC NSCIDUS, have victim orink water """ ""DUCE VOV TING.		
Water Pollution	Fouling 1 May be d Notify for	IL TO ADUATIC L c shoreline, langerous if it enti- cal neath and wid relators of nearby	safe officiels.	CENTRATIONS.
RESPORE (See Response Mechanical of Should be re Chemical and	containment moved	iandbook)	2. LABEL 2.1 Category: Fi 2.2 Class: 3	ammable liquid
3. CHEMIC hydrocarbon in the comparation of the comparation in the com	CH ₁ CH ₂ ation: 3.3/1	omatic	1	
2 Symptome Foli Moderate irrit 3 Treatment of E warm and qui INGESTION: chemical pre	lowing Expl ation of eye exposure: If iet, and get inducs vom	ment: Self-contain peure: Inhalation i with comeal injuri NHALATION: If it is medical help pron ting only upon phy	y possible, Irritates skin effects occur, remove vi optly; if breathing stops, ysician's approval; mater comptly flush with planty	oee, dizziness, depression, and may cause blisters, nitm to tresh ak, keep him give artificial respiration, ital in lung may cause of water (15 min, tor eyes)

commission presumentus. Source value ETES: promptly trush with plenty of water (15 m and get medical attention; remove and wash contaminated clothing before reuse. Threshold Limit Value; 100 ppm.

Short Term Inhalation Limits: 200 ppm for 30 min.

Toxicity by Ingestion: Grade 2; LDvs = 0.5 to 5 g/kg (rat)

Late Toxicity; Data not available.

5.7 Late Texicity: Data not available
5.8 Vapor (Gae) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The affect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Causes smarring of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 Odor Threshold: 140 ppm
5.11 IDLH Value: 2,000 ppm

 $\mathcal{L}_{\mathbf{r}} = \{ \mathbf{r}^{\mathbf{r}} \in \mathcal{L}_{\mathbf{r}} \mid \mathbf{r}^{\mathbf{r}} \in \mathcal{L}_{\mathbf{r}} \mid \mathbf{r}^{\mathbf{r}} \in \mathcal{L}_{\mathbf{r}} \mid \mathbf{r}^{\mathbf{r}} \in \mathcal{L}_{\mathbf{r}} \} \}$

6. FIRE HAZARDS	10. HAZARD ASSESSMENT CODE
5.1 Flash Point: 50°F O.C.; 59°F C.C.	(See Hazard Assessment Handbook)
6.2 Flammable Limits in Air, 1.0%-6.7%	A-T-U
6.3 Fire Extinguishing Agents: Foam (most	
ettective), water tog, carbon dioxide or dry chemical.	<u> </u>
6.4 Fire Extinguishing Agents Not to be	11. HAZARD CLASSIFICATIONS
Used: Not pertinent	
6.5 Special Hazards of Combustion	11.1 Code of Federal Regulations:
Products: Irritating vapors are generated	Flammable liquid 11.2 NAS Hazard Rating for Bulk Water
when healed.	Transportation:
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to	Category Rating
the source of ignition and flash back.	Fire
6.7 Ignition Temperature: 860°F	Health
6.8 Electrical Hazard: Not pertinent	Vapor Irritani
6.9 Burning Rate: 5.6 mm/min.	Liquid or Solid Irritant
6.10 Adiabatic Flame Temperature: Data Not Available	Water Polution
Data 1101 Pransolu	Human Toxicity 1
(Continued)	Aquatic Toxicity 3
7. CHEMICAL REACTIVITY	Aesthetic Effect
	Resctivity Other Chemicals 1
7.1 Reactivity With Water, No reaction	Water
7.2 Reactivity with Common Materials: No teaction	Self Reaction
7.3 Stability During Transport: Stable	11.3 HFPA Hazard Classification:
7,4 Neutralizing Agents for Acids and	Category Classification
Caustics: Not pertinent	Health Hazard (Blue)
7.5 Polymertzation: Not pertinent	Reactivity (Yellow)0
7.6 Inhibitor of Polymerization: Not pertinent	
7.7 Molar Ratio (Reactant to	•
Product): Data Not Available	
7.8 Reactivity Group: 32	
<u></u>	
	12. PHYSICAL AND CHEMICAL PROPERTIES
	12.1 Physical State at 15°C and 1 atm:
	Liquid
	12.2 Molecular Weight: 106.17
	12,3 Bolling Point at 1 stm: 277,2°F = 136,2°C = 409,4°K
	12.4 Freezing Point:
2. WATER POLLUTION	-139'F = -95'C = 178'K
	12.5 Critical Temperature:
8.1 Aquatic Toxicity: 29 ppm/96 ht/bluegiil/TL _m /fresh water	651,0°F = 343.9°C = 617,1°K 12.6 Critical Pressure:
8.2 Waterfowi Toxicity: Data not available	523 psis = 35.6 stm = 3.61 MN/m ³
8.3 Biological Oxygen Demand (BOD):	12.7 Specific Gravity:
2.8% (theor.), 5 days	0.567 at 20°C (liquid)
8.4 Food Chain Concentration Potential:	12.8 Liquid Surface Tensions
None	29.2 dynes/cm = 0.0292 N/m at 20°C 12.9 Liquid Water Interfacial Tenalon:
	35.48 dynes/cm = 0.03548 N/m at
· [20°C
	12.10 Vapor (Gas) Specific Gravity:
	Not pertinent
	12,11 Ratio of Specific Heats of Vapor (Gas): 1,071
•	12.12 Latent Heat of Vaporization:
ľ	144 Btu/lb = 80.1 cal/g ==
	3.35 X 10° J/kg
9. SHIPPING INFORMATION	12.13 Heat of Combustion: -17,780 Btu/lb
9.1 Grades of Purity: Research grade:	⇒ —9877 cat/g = ←413.5 X 10 ⁸ J/kg 12.14 Heat of Decomposition: Not pertinent
99.98%; pure grade: 99.5%; technical	12.15 Heat of Solution: Not pertinent
grade: 99.0%	12.16 Heat of Polymerization: Not pertinent
9.2 Storage Temperature: Ambient	12.25 Heat of Fusion: Data Not Available
9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or	12.26 Limiting Value: Data Not Available
pressure-vacuum	12,27 Reid Vapor Pressure: 0.4 psis
-	
S. FIRE HAZAI	RDS (Continued)
6.11 Stolchiometric Air to Fuel Ratio: Data Not A	•

Stoichiometric Air to Fuel Ratio: Data Not Available
 Fleme Temperature: Data Not Available

and the commentation and the second section is a second

ETHYLENE DIBROMIDE

Common Synon 1, 2-Dibromoethane Ethylene bromice Bromolume sym-Dibromoethane Dow-fume 40, W-10, M Glycol dibromide	Sinks in wat	Colorless Sweet ador er. Poisonous vapor is produced. ezing point is 50°F.	6. FIRE HAZARDS 6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air; Not flammable 6.3 Fire Extinguishing Agents: Not pertinent 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X
Avoid contain	ige if possible. Keep peop of with ligurd and vapor, remove discharged mater, health and pollution contro	sil.	Special Hazards of Combustion Products: Decomposition gases are toxic and irritating. 6.6 Behavior in Fire: Decomposes into toxic irritating gases. Reacts with hot metals such as aluminum and magnesium. 6.7 Ignition Temperature: Not Ilammable	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: ORM-A 11.2 NAS HAZARD Rating for Bulk Water Transportation: Category Rating
Fire	Not itemmable. POISONOUS GASES Wear gopples, self-cor (including plo- Cool exposed contains	ARE PRODUCED WHEN HEATED. Rained Dresting Epparatus, and rubber exerciciting etc.). Its with water.	6.8 Electrical Hazard: Not perinent 6.9 Burning Rafe: Not llammable 6.10 Adlabatic Flame Temperature: Date Not Available 6.11 Stoichiometric Air to Fuel Ratio: Date Not Available 6.12 Flame Temperature: Data Not Available	Fire
Exposure	If breathing is official LIOUID POISONOUS IF SWAL Innating to skin and ey femove contaminated Flush affected areas with IN EYES, hold evelo	LED. and throat. c. give artificial respiration. give crysten. LOWED OR IF SKIN IS EXPOSED. es. cottoning and shoes.	7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustica: Not peninent 7.5 Polymerization: Not perinent 7.6 Inhibitor of Polymerization: Not perinent 7.7 Molar Ratio (Reactant to Product): Data Not Available 7.8 Reactivity Group: 36	Reactivity
Water Pollution	HARMFUL TO AQUATI May be dangerous if it Notify local health and Notify operators of nea	wilclife officials.	-	12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Locid 12.2 Molecular Weight: 157.65 12.3 Boiling Point at 1 atm: 265°F = 131°C = 404°K 12.4 Freezing Point
(See Response Should be re	HSE TO DISCHARGE Methods Handbook) imoved d physical treatment	2. LABEL 2.1 Category: None 2.2 Class: Not pertinent	8. WATER POLLUTION 8.1 Aquatic Toxicity: 15 mg/l/48 hr/bluegill/tresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None	48.6°F = 9.6°C = 283.0°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 2.180 at 20°C (liquid) 12.8 Liquid Surface Temsion: 38.75 dynes/cm = 0.03675 N/m at 20°C 12.9 Liquid Water Interfacial Tension:
	CH _* Br sation: 6.1/1605 05	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Uquid 4.2 Color: Coloriess 4.3 Odor: Mildly sweet; like chloroform		36.54 dynes/cm = 0.03654 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not perinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.109 12.12 Latent Heat of Vaporization: 62.1 Blu/lb = 45.6 cal/g = 1.91 X 10 ⁵ J/kg
chemical sali \$.2 Symptoms For and organic i \$.3 Trestment of E soap and wa' \$.4 Threshold Lim \$.5 Short Term In \$.5 Short Term In \$.6 Toxicity by Ing \$.7 Late Toxicity; \$.8 Vapor (Gas) In system k pres \$.9 Liquid or Solid \$.9 Liquid or Solid	ctive Equipment Canists any popples. Howing Exposure: Local in injury to liver and kidneys; Exposure: Remove from a ter. Flosh eyes with plenty it Value: 2 ppm halation Limits: 50 ppm frestion: Grade 3; LDs = Data not available ritiant Characteristics: Vasent in high concentration: Irritant Characteristics: cause smarting and reode cause smarting and reode	50 to 500 mg/kg pors cause a slight smarting of the eyes or respiratory by The effect if temporary. Minimum hazard, if spilled on clothing and allowed to	9. SHIPPING INFORMATION 9.1 Grades of Purity: Commercial 9.2 Storage Temperature; Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum	12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.18 Heat of Polymerization: Not pertinent 12.26 Heat of Fusion: 13.79 cal/g 12.26 Limiting Value: Data Not Available 12.27 Reid Vapor Pressure: 0.4 paia
5.11 IDLR Value: 40	0 ppm		NO.	TES

TETRAETHYL LEAD

Common Synon TEL Lead tetraethyl		Colorless, but Fruity odor generally dyed red r, Poisonous, flammable vapor is produced.	6. FIRE HAZARDS 6.1 Flash Point: 200'F C.C.; 165'F O.C. 6.2 Flammable Limits in Air: Data not available 6.3 Fire Extinguishing Agents: Water, loam,	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X-Y
West google (incl Stop dischar Call fire depi Stay upwind Isolate and t	s, self-contained bresthing uding glovesh, ge if possible, striment, and use water spray to "k emove discharged material neath and pollution control Combostible, possionalities (2.655.6		dry chemical, or carbon dioxide 6.4 Fire Extingulahing Apenta Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Producta: Toxic gases are generated in fires. 6.6 Behavior in Fire: May explode in fires. 6.7 ignition Temperature: Decomposes above 230°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Data not available	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Poison, B 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue)
Fire	Flood discharge area w	to be ment of projected location. It water, y chemical, toam, or carbon dioxide.	6.10 Adiabatic Flame Temperature: Data not available (Continued)	Reactivity (Yellow) 3
Exposure	Imating to eyes. Move to fresh air, If breathing has stopped to breathing has stopped to breathing has stopped to breathing has stopped to breathing has stopped LIQUID POISONOUS IF SWALL Will born eyes. Remove contaminated or Flush affected sreas wit if IN EYES, hold eyeld IF SWALLOWED and w	ED OR IF SKIN IS EXPOSED. , give anticial respiration. ve crypen. OWED OR IF SKIN IS EXPOSED. Ictimop and shoes. penny of water. poen and diush with plenty of water. crim is CONSCIOUS, here wichm orink water tim induce vombing. Itim is VENCHOSCIOUS OR HAVING CONVULSIONS.	7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Rust and some metals cause decomposition. 7.3 Stability During Transport: Stable below 200°F. At higher temperatures, may detonate or explode when confined, 7.4 Neutralizing Apents for Acids and Caustles: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reaction to Product): Data not available 7.8 Reactivity Group: Data not available	12. PHYSICAL AND CHEMICAL PROPERTIES
Water Pollution	HARMFUL TO AQUATE May be dangerous if it Notify local health and Notify operators of near	didite officials.		12.1 Physical State at 15°C and 1 atm: Louid 12.2 Molecular Weight: 322.44 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: —215°F = —13°C = 136°K
(See Response Issue warnin water or Restrict acco Should be re Chemical an	ontaminant ess	2. LABEL 2.1 Catepory: Poison 2.2 Class: 6	2. WATER POLLUTION 3.1 Aquetic Toxicity: 0.20 mg/l/96 hr/bluegill/TL_/fresh water 3.2 Waterfowl Toxicity: Data not available 3.3 Blological Oxygen Demand (BOD): Data not available 3.4 Food Chain Concentration Potential: Data not svailable	12.5 Crrtical Temperature: Not pertinent 12.6 Crrtical Pressure: Not pertinent 12.7 Specific Gravity: 1.633 at 20°C (Kquid) 12.8 Liquid Surface Tension: 25.5 dynes/cm = 0.0255 N/m at (est.) 25°C 12.9 Liquid Water Interfacial Tension: (est.) '40 dynes/cm = 0.04 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity;
3.1 CG Competibilit 3.2 Formula: Pb(Cs 3.3 IMO/UN Design 3.4 DOT ID Noc 16 3.5 CAS Registry h	ty Class: Not listed Hs]s sation: 6,1/1649 49	4.1 Physical State (as shipped): Liquid 4.2 Color: Dyed red or other distinctive color, 4.3 Odor: Sweet	·	Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: (est.) —7,670 Etu/lb — —4,380 cal/g = —183 X 10 ^s J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent
type for long white or light 5.2 Symptoms Fol from inhalstic not combae : 5.3 Treatment of I immediately, petroleum 6: 5.4 Threshold Lim 5.5 Short Term ini 5.6 Toxicity by ing 5.7 Lats Toxicity; 5.8 Vapor (Gas) in	active Equipment: Organicer periods; neoprene-coale-colored ciohing; rubber a knowing Exposurer; Increason or skin contact, may cawth inorganic lead. Exposurer: Remove wictim INGESTION: Induce vomit stillate followed by soap ar it Values 0.1 mg/m² halablon Limitas 0.15 mg Fpertion; Oral rat LD _{Le} = 1 Lead poisoning ritant Characteristics; Va.	ad urinary output of lead. If a large degree of absorption me insomnia, excitability, delirium, come and death. Do from contaminated area and consult physician ng. SKIN: wash immediately with herosene or similar d water. b/m² for 30 min. r mg/kg cos cause a slight smarting of the eyes or respiratory	9. SHIPPING INFORMATION 9.1 Grades of Purity: Technical 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere; No requirement 9.4 Venting: Pressure-vacuum	12.16 Heat of Polymerization: Not pertinent 12.26 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available
5.9 Liquid or Solid	re; may causs secondary l id: Data not avallable	Causes smarting of the skin and first-degree burns on	FIRE HAZA 6.11 Stoichiometric Air to Fuel Ratio: Data not a 6.12 Flame Temperature: Data not available	RDS (Continued) vakable

Common Synonyma	Watery liquid	Colorless Pleasant odor	6. FIRE HAZARDS	10. HAZARD ASSESSMENT CODE
Toluol Methylpenzene Methylpenzol	Floats on water. I	Flammable, irritating vapor is produced.	Flash Point: 40°F C.C.; 55°F O.C. Flammable Limits in Air; 1,27%-7% Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.	(See Hazard Assessment Handbook) A-T-U
Shot oft ignition s Stay upwind and Avoid contact wit lanks and tempo	possible. Keep people awa sources and call line depart use water spray to "knock in liquid and vapor, we discharged material, h and pollution control ager	ment. down" vzpor.	6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pentinent 6.6 Behavior in Fire: Vapor is heavior than air and may travel a considerable distance to	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating
Fire W	LAMMABLE, inshiback along vapor trail abbor may explode it ignited law opposes and self-contacting with a suringuish with dip chemosal later may be ineffective on ool exposed containers will	in an enclosed area. ined breathing apperatus. floam, or carbon dioxide. fire.	e source of ignition and flash back. 6.7 Ignition Temperature: 997 F 6.5 Electrical Hazard: Class I, Group D 6.9 Burning fisite: 5.7 mm/min. 6.10 Adlabatic Flame Temperature: Data not available (Continued)	Fre
Exposure	difficult breathing, or los love to fresh air. breathing has stodded, give breathing difficult, give day JOUID minute to skin and eyes, swallowed, will cause nautemove contaminated clothing.	voming, headache, dizziness, so consciousness, e aminist respiration. sea, vomining or loss of consciousness, or and shoes. sen and shoes. sen of water, and an	7. CHEMICAL REACTIVITY 7.1 Reactivity With Water. No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Apents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactiant to Product): Data not available 7.6 Reactivity Group: 32	Rescrivity Other Chemicals
Water Ex	angerous to aquatic life in louling to shoreline, lay be dangerous if it enten citry local health and wildlift only operators of nearby wi	e officials.		PHYSICAL AND CHEMICAL PROPERTIE Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 92.14 12.3 Boiling Point at 1 atm: 291.1°F = 110.6°C = 383.8°K 12.4 Freezing Point:
RESPONSE (See Response Met Issue warning-hig Evacuate area	thods Handbook)	2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3	8. WATER POLLUTION 8.1 Aquatic Toxicity: 1180 mg/l/P5 hr/sumfish/TL_/tresh water 8.2 Waterfowl Toxicity: Date not available 8.3 Biological Oxygen Demand (BOD): 0%, 5 days: 38% (theor), 6 days 8.4 Food Chain Concentration Potentials	
3. CHEMICAL I 3.1 CG Compatibility Cl Hydrocarbon 3.2 Formula: C+H ₂ CH ₃ 5.3 IMO/UN Designation 3.4 DOT ID No.2 12P4 3.5 CAS Registry No.2 1	lasa: Aromatic nr: 3.2/1294	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Coloriess 4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant	None	29.0 dynes/cm = 0.0290 N/m at 20 12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 20 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas) 1.089 12.12 Latent Heat of Vaportzation: 155 Btu/lb = 86.1 cal/g =
5.2 Symptoms Followin headache, anesth aspirated, causes ingested causes of the second cause	e Equipment: Air-supplied in Exposurer: Vapors irrital resia, respiratory amest. Liq. coughing, gaspging, distress vomiting, griping, diarrhea, essurer: INHALATION: removator. INGESTION: do NOT 15 min. SKIN: wipe off, waluer: 100 ppm ion Limits: 600 ppm for 30 on: Grade 2; LDs = 0.5 key and liver damage may for Characteristics: Vapors in high concentrations. The limits Characteristics: Minimant Characteri	e to fresh air, give artificial respiration and oxygen if induce vomiting; call a doctor, EYES; flush with sh with soap and water. I min, I 5 g/kg Nicw ingestion. Lause a slight smarting of the eyes or respiratory effect is temporary, um hazard, if spilled on clothing and allowed to	9. SHIPPING INFORMATION 9.1 Grades of Purity: Research, reagent, nitrationall 99.8 + %; industrial: contains 94 + %, with 5% system and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial. 9.2 Sibrage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (fiame arrester) or pressure-vacuum	5.61 X 10 ³ J/kg 12.13 Heat of Combustion: —17,430 Btu/lb = -9665 Cat/g = -405.5 X 10 ³ J. 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.25 Heat of Fusion: 17.17 cat/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 1.1 psia
remain, may caust i,10 Odor Threshold: 0. i,11 IDLH Value: 2,000 p		if the skin.	S. FIRE HAZAI Stolchiometric Air to Fuel Retio: Data not a S.12 Flame Temperature: Data not available	•

Common Synon 3-Dimethylbenzene ylol			Colorless this, irritating va	Sweet odor		
	FIORE ON	valer, Flammi	me, kumung val	oor is produced,		
Call fire dep	"I with bound and vapor					
labiate and r	emove discharged mater health and pollution contr	ial. of apencies.				
	FLAMMABLE		1			
	Flashback along vapor Vapor may explode if Wear self-contained b Estinguish with foam,	ns ni benngi acca chintsan	enciosed area. :Elus.	ie.		
Fire	Water may be ineffect Cool exposed contain	ive or tre.		••		
	•					
	CALL FOR MEDICAL	AID.				
1	Impains to eyes, nose it inhaled, will cause to consciousness.	e, and throat. neadache, diff	icult breathing, c	r loss of		
	Move to fresh air. If breatning has stopp If breathing is officult.	ed, give anilio pive oxygen,	al respiration.			
Exposure	LIQUID trataing to skin and e if swallowed, will caus	• *				
·	Remove contaminated ciching and shoes. Flush, affected areas with plenty of water. If he EYES, hold eyelding open and flush with plenty of water. IF SWALLOWED and worth is CONSCIOUS, have victim drink water.					
	or milk.	OT INDUCE VOMITING.				
	HARMFUL TO AQUAT	TIC LIFE IN V	ERY LOW CON	CENTRATIONS.		
Water חסולעונסי	Fouling to shoreline, May be dangerous if it Notify local health and	wilgiste othicis	ils.			
	hostly operators of nei	erby water into	2. LABEL			
(See Response	(SE TO DISCHARGE Methoda Handbook) p-high flammability		Category: Fla Class: 3	immable liquid		
Evacuate are Should be re	4					
Chemical and	i physical treatment					
3. CHEMIC	AL DESIGNATIONS		4. OBSERVA	BLE CHARACTERISTICS		
3.1 CG Competibility Hydrocarbon	•	4.2	Color: Colorie			
3.2 Formula: m-Cell 3.3 IMO/UN Design 3.4 DOT ID No.; 130	etion: 3.2/1307	4.3	OODS DEED	nzene; characteristic aromatic		
3.6 CAS Registry N						
1	5.					
plastic gloves	and boots.			ask; googles or face shield; ess. Liquid irritates eyes and		
skin, II taken edema, II Ing	into lungs, causes sever ested, causes nauses, vi	e coughing, d	stress, and rapid	dly developing pulmonary of coma; can be fatal, Kidney		
5.3 Treatment of E	and liver damage can occur. Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen it required; call a doctor. INGESTION: do NOT induce vortising; call a doctor. EYES:					
flush with wat \$.4 Threshold Limit	ler for at least 15 min. Si t Value: 100 ppm	KIN: wipe off,				
E.S Toxicity by Ing	elation Limits: 300 ppm estion: Grade 3; LDse = Gdney and liver damage.	50 to 500 g	/kg			
5.8 Vapor (Gas) Irr system if pres	tant Characteristics: Vi ant in high concentration	spors cause a ns. The effect	is temporary.	of the eyes or respiratory		
remain, may o	suse smarting and tedde			n clothing and allowed to		
5.10 Odor Threshold 5.11 IDLN Value: 10,						

6. FIRE HAZARDS 6.1 Flash Point: 64°F C.C. 6.2 Flammable Limits in Air; 1,1%-6,4% 6.3 Fire Extinguishing Apents: Foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Apents Not to be Used: Water may be ineffective. 6.5 Special Hazards of Comburation Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may tavel considerable distance to a source of ignition and flash back. 6.7 Ignition Temperatures: 986°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.8 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available 7. CHEMICAL REACTIVITY 7.1 Rescrivity With Water: No reaction 7.2 Rescrivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Apents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Rescriant to Product): Data not available 7.8 Rescrivity Group: 32	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U 11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulationa: Flammable liquid 11.2 MAS Hazard Retring for Bulk Water Transportation: Category Rating Fie
3. WATER POLLUTION 3.1 Aquatic Toxicity: 22 ppm/96 fr/bluegil/TL_/fresh water 3.2 Waterfowl Toxicity: Data not available 3.3 Blological Oxygen Demand (BOD): 0 lo/fo, 5 days; 0% (theor.), 5 days 3.4 Food Chain Concentration Potential: Data not available 9. SHIPPING INFORMATION 9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2% 9.2 Storage Temperature: Ambient 9.4 Venting: Open (flame arrester) or pressure-vacuum	12. Physical AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 stm: Liquid 12.2 Molecular Weight: 106.16 12.3 Boiling Point at 1 stm: 269.4°F = 131.9°C = 405.1°K 12.4 Freazing Point: −54.2°F = −47.9°C = 225.3°K 12.5 Critical Temperature: 650.6°F = 343.6°C = 617.0°K 12.6 Critical Temperature: 513.6 atm = 34.95 paia = 3.540 MN/m¹ 12.7 Specific Gravity: 0.864 at 20°C (liquid) 12.1 Liquid Surface Tension: 26.6 dynes/cm = 0.0286 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0286 N/m at 30°C 12.10 Vapor (Gae) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heasts of Vapor (Gae): 1.071 12.12 Letent Heat of Vaportization: 147 Bill/b = 81.9 cal/g = 3.43 × 10°J/lg 12.13 Heat of Combustion: ~17,554 Bill/b = −97524 cal/g = −406.31 × 10°J/lg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Fusion: 26.01 cal/g 12.27 Reid Vapor Pressure: 0.34 paia
NO	TES

Diesel Oil (fuel oil #2)

Physical and chemical description: flammable, slightly viscous brown liquid obtained from the distillation of crude petroleum. Diesel oil is a mixture of hydrocarbons, predominately unbranched alkanes of 10-16 carbon atoms with smaller amounts of aromatic and polynuclear aromatic hydrocarbons (PAH's). Diesel oil floats on water, having a specific gravity of less than 1.

Uses: fuel for trucks, ships, and trains.

Toxicity: Because of their water solubility and carcinogenicity, benzene and PAH's are the chemicals of health concern in diesel oil. Benzene, found in trace amounts in diesel oil, is known to cause leukemia, a cancer of the blood forming cells. PAH's as a class (1-10% in diesel) are considered to be carcinogenic to a number of animal species. Benzo(a)pyrene is one of the most commonly found and carcinogenic PAH. The alkanes of 10-16 carbon atoms, which make up the bulk of diesel oil, are of less concern due to their very low water solubility and low toxicity.

Concentration Guidelines and Standards: The maximum tolerable concentration for diesel oil in drinking water is 100 ug/l, due to organoleptic (taste and smell) considerations. The EPA Office of Drinking Water recommends that the short term concentrations of PAH's in drinking water not exceed 25 ug/l. This is the 7 day suggested no adverse response level (SNARL) and does not take into account the long term cancer risk. These concentrations should be tolerated only in emergency situations where no other higher quality water source is available.

Naphthalene (C10Hg)

Physical and Chemical Description: white crystalline solid with a characteristic "moth ball" odor. Naphthalene is more dense than water (sp. gr. 1.145) and has a solubility of 30,000 - 40,000 ug/l @ 25°C. It melts at 80°C but will sublime (volatilize from a solid) at room temperature. Naphthalene is considered a polynuclear aromatic hydrocarbon (PAR).

Uses: intermediate in dye production and formation of solvents, lubricants, and motor fuels. Used directly as a moth repellant.

Toxicity: Naphthalene may be absorbed by inhalation, ingestion or skin or eye contact. Chronic exposure can cause cataracts, kidney disease and red blood cell breakdown, especially in infants and individuals deficient in the enzyme G6PD. Naphthalene has been shown to be nonmutagenic and noncarcinogenic.

Classification: Hazardous Substance (EPA)

Hazardous Waste (EPA)

Priority Toxic Pollutant (EPA)

Persistance: Naphthalene can oxidize in the presence of light and air, 50% after 14 days in one study. Microbial degradation has also been demonstrated in the laboratory in solutions as concentrated as 3.3 ug/l. Little breakdown is expected, however, under the dark, anaerobic conditions characteristic of in-situ ground water.

Phenanthrene (C14H10)

Physical and Chemical Description: colorless, monoclinic crystals soluble in water, 1,000-1,300 ug/1 @ 2.5°C, specific gravity = 1.179. Phenanthrene is a PAH.

Uses: dyes, explosives, a natural constituent of coal tar and of diesel oil (0.35%).

Toxicity: Phenanthrene has been identified as a mild allergen and human dermal photosensitizer. Limited acute and chromic animal experiments show it to be of low to moderate toxicity.

Classification: none

Fluorene (C13H10)

Physical and Chemical Description: Combustible white solid having a density of 1.20 and a water solubility of 1980 ug/l.

Uses: Manufacture of dyestuffs.

Toxicity: Little specific information is available about the toxicity of fluorene but it is a polynuclear aromatic hydrocarbon (PAH), a group which contains known human carcinogens.

Classification: None

5.0 SITE CONTROL

- <u>5.1 ZONATION</u>. Due to the nature of the work (multiple soil borings and well installations throughout the study area) and the properties of the potential chemicals found onsite, typical exclusion, contamination reduction, and support zones are not necessary or practical at all locations. Therefore, where appropriate, a "floating" exclusion zone in the perimeter of the sampling site will be established to eliminate access to the area by individuals not working on the project or involved in the assessment work. The perimeter will be at least 20 feet in radius and moved accordingly as the assessment points are moved.
- <u>5.2 COMMUNICATIONS</u>. When radio communication is not used, the following air horn signals will be employed:

HELP	three short blasts	(• • •)
EVACUATION	three long blasts	()
ALL CLEAR	alternating long and she	ort blasts (

- <u>5.3 WORK PRACTICES</u>. General work practices to be used during ABB-ES projects are described in Chapter 9.0 of the CLEAN HASP. Work at the site will be conducted according to these established protocol and guidelines for the safety and health of all involved. Specific work practices necessary for this project or those that are of significant concern are described as follows.
- Work and sampling will be conducted in Level D clothing and equipment.

6.0 DECONTAMINATION AND DISPOSAL

- All personnel and/or equipment leaving contaminated areas of the site will be subject to decontamination, which will take place in the contamination reduction zone. General decontamination practices used during ABB-ES projects are described in Chapter 13.0 of the CLEAN HASP.
- 6.1 PERSONNEL DECONTAMINATION. All personnel leaving the study area are subject to decontamination (as necessary). The decontamination procedure required will be determined by the nature and level of contamination found at the sites. At a minimum, site personnel will remove loose soils from boots and clothing before leaving the site. More thorough decontamination procedures will be observed as dictated by site conditions. These procedures are described in Chapter 13.0 of the CLEAN HASP.
- 6.1.1 Small Equipment Decontamination Small equipment will be protected from contamination as much as possible by keeping the equipment covered when at the site and placing the equipment on plastic sheeting, not the ground. Sampling equipment used at the site will be used only once or will be field cleaned between samples with soapy water (Alconox), rinsed with clean water, rinsed with an approved Quality Assurance/Quality Control solvent, and final rinsed with organic free water.
- 6.1.2 Heavy Equipment Decontamination Drilling equipment will be protected from contamination as much as possible by placing the equipment on plastic sheeting, not the ground. The drill rig and associated drilling equipment will be cleaned with high pressure water or high pressure steam followed by a soap and water wash and rinse. Loose material will be removed by brush. The person performing this activity will be at the level of protection used during the field investigation.
- <u>6.2 COLLECTION AND DISPOSAL OF DECONTAMINATION PRODUCTS</u>. All disposable protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will be disposed of at the site. Decontamination fluids (i.e., isopropanol [e.g., split spoons and groundwater sampling pump]) will be stored in amber glass bottles. Disposable materials (e.g., gloves and Tyveks $^{\mathrm{TM}}$) will be bagged and disposed of properly.

7.0 EMERGENCY AND CONTINGENCY PLAN

This section identifies emergency and contingency planning that has been undertaken for operations at this site. Most sections of the HASP provide information that would be used under emergency conditions. General emergency planning information is addressed in Chapter 14.0 of the CLEAN HASP. The following subsections present site-specific emergency and contingency planning information.

- 7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS. The site HSO or the Health and Safety designee is the primary authority for directing operations at the site under emergency conditions. All communications both on- and off-site will be directed through the HSO or designee.
- 7.2 EVACUATION. Evacuation procedures at the site will follow those procedures discussed in Chapter 14.5 of the CLEAN HASP for upwind withdrawal, site evacuation, and evacuation of the surrounding area. Evacuation from the DFSP facility will be conducted with all personnel meeting at the main facility gate at the northwest corner of the site. Evacuation will proceed by travelling south (left) on North Rhett Boulevard, away from the site.
- 7.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID. Any personnel injured on-site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

8.0 ADMINISTRATION

8.1 PERSONNEL AUTHORIZED DOWNRANGE. Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Project Manager and the HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must use the buddy system, and check in with the Site Manager and/or HSO before going downrange.

CERTIFIED ABB ENVIRONMENTAL TEAM PERSONNEL:

	+ Ken Busen	<u>+ Joe Daniels</u>
	*+ Peter Redfern	*+ Andrew Harvey
	*+ Jay Koch	*+ Kathleen O'Neil
	*+ Alan Stodghill	*+ Peggy Layne
	*+ Kevin Warner	
OTHER	CERTIFIED PERSONNEL:	•
ŕ	Total Control	

- * FIRST-AID-TRAINED
- + CPR-TRAINED

8.2 HEALTH AND SAFETY				
undersigned certify that	this HASP will	be used for th	e protection of the	nealth
and safety of all person	s entering this	s site.		
Health and S Project Mana	afory officer		May 7/9/ Date 5/17/9/ Date Date	
8.3 FIELD TEAM REVIEW	T have res	ad and reviews	d the health and	cafetar
information in the HASP.		the information	n and will combin wr	th the
requirements of the HASP	•			
-				
· NAME:				
1/1111111111111111111111111111111111111				
DATE:		·· ···································		
SITE/PROJECT:			_	

assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet. Project: Name: Address: Home Telephone: Area Code () Age: ____ Height: ____ Weight: _____ In case of emergency, contact: _____ Address: _____ Telephone: Area Code () Do you wear contact lenses? Yes () No () Allergies: List medication(s) taken regularly: _____ Particular sensitivities: Previous/current medical conditions or exposures to hazardous chemicals: Name of Personal Physician: Telephone: Area Code ()

8.4 MEDICAL DATA SHEET. This Medical Data Sheet will be completed by all on-site personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with

This data sheet will accompany any personnel when medical

8.5 EMERGENCY TELEPHONE NUMBERS.

Police Department	(803) 747-5711
Primary Hospital (U.S. Naval Hospital	(803) 743-5130
Alternate Hospital (Baker Hospital)	(803) 744-2110
Base Fire Department	(803) 744-4073
Off-site Emergency Services	(803) 744-4073
Poison Control Center	(800) 962-1253
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(800) 414-8802
Site HSO: Alan Stodghill	(904) 656-1293
General Site Supervisor: <u>Ken Busen</u>	(904) 656-1293
Project Manager: Peter Redfern	(904) 656-1293
ABB Environmental HSM: _C.E. Sundquist	(207) 775-5401 x101

8.6 ROUTES TO EMERGENCY MEDICAL FACILITIES. The primary source of medical assistance for the site is:

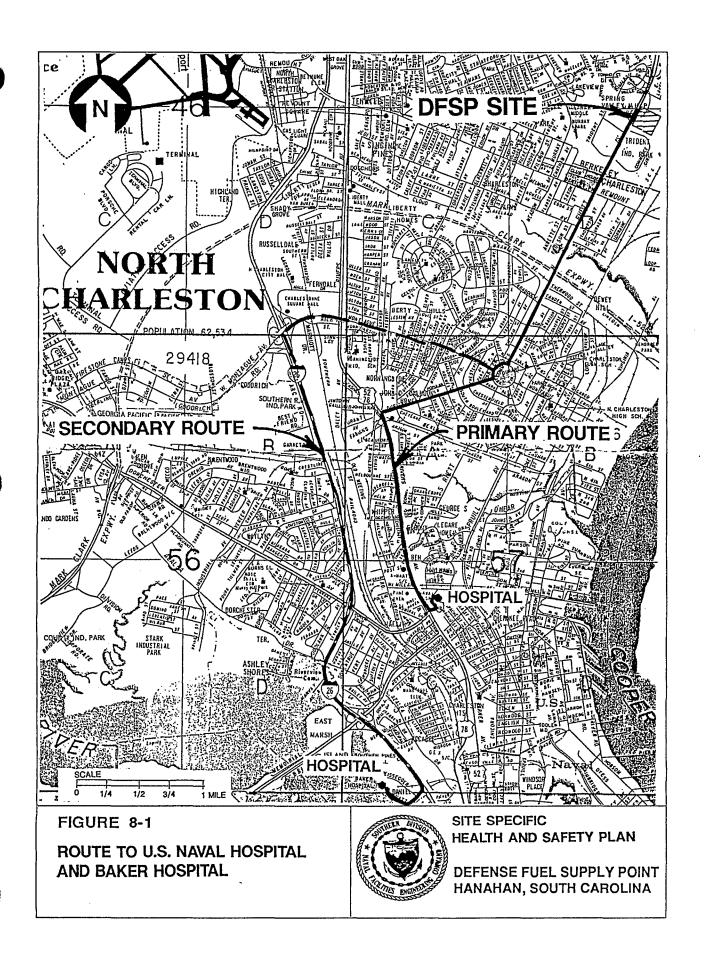
U.S. Naval Hospital Charleston, South Carolina

<u>DIRECTIONS TO PRIMARY</u>: Take Rhett Ave. (Hwy 136) south to Park Circle. Turn right and drive around Circle until you reach Montague Ave. Go west on Montague Ave. until you reach Interstate 26. Take Interstate 26 south approximately 3.5 miles. Hospital is on the right side of the Interstate. See Figure 8-1.

The alternate source of medical assistance for the site is:

Baker Hospital Charleston, South Carolina

<u>DIRECTIONS TO ALTERNATE</u>: Take Rhett Ave. (Hwy. 136) south to Park Circle. Turn right and drive around circle until you reach Durant Ave. Go west on Durant Ave. until you reach Rivers Ave. Take Rivers Ave.south approximately 1.5 miles. Hospital is on the left side of Rivers Ave. See Figure 8-1.



JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm or employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides the employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each nonserious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Sasety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control emplyee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving sasety and health problems or can refer you to other sources for health such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. The programs are usually administered by the State labor or Health department or a State university.

POSTING INSTRUCTIONS.

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

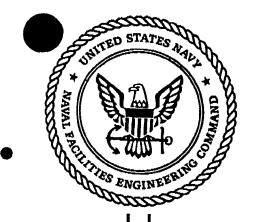
More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia (404) 347-3573 Boston, Massachusetts (617) 565-7164 Chicago, Illinois (312) 353-2220 Dallas, Texas (214) 767-4731 Denver, Colorado (303) 844-3061 Kansas City, Missouri (816) 426-5861 (212) 337-2325 New York, New York Philadelphia, Pennsylvania (215) 596-1201 (415) 995-5672 San Francisco, California Settle, Washington (206) 442-5930 Washington, D.C. 1989 (Revised) OSHA 2203

Elizabeth Dole, Secretary of Labor
U.S. Department of Labor
Occupational Safety and Health Adminstration

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.



MAY 1991 CONTAMINATION ASSESSMENT PLAN HEALTH AND SAFETY PLAN

PLUME DELINEATION
DEFENSE FUEL SUPPLY POINT
HANAHAN, SOUTH CAROLINA



SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND CHARLESTON, SOUTH CAROLINA 29411-0068

> FINAL DRAFT NOT FOR PUBLIC RELEASE

CONTAMINATION ASSESSMENT PLAN

PLUME DELINEATION DEFENSE FUEL SUPPLY POINT HANAHAN, SOUTH CAROLINA

CTO NO.: 00010

CONTRACT NO. N62467-89-D-0317

Prepared by:

ABB Environmental Services, Inc. 2571 Executive Center Circle East Tallahassee, FL 32301-5001

Prepared for:

Department of the Navy Southern Division Naval Facilities Engineering Command 2155 Eagle Drive Charleston, South Carolina 29411-0068

Ted Campbell, Engineer-In-Charge

MAY 1991

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1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES) was contracted by the Naval Facilities Engineering Command, Southern Division (SDIV) to prepare a Contamination Assessment Plan (CAP) for the Defense Fuel Supply Point (DFSP), Hanahan, South Carolina. The purpose of the CAP is to outline a field investigation and sampling program that will assess the source and extent of petroleum contamination along the eastern and western boundaries of the site. The investigation and subsequent report will be presented by SDIV to the South Carolina Department of Health and Environmental Control (SCDHEC) for review. The following report presents the site location, summarizes previous investigations, and develops the rationale for the proposed monitoring plan to be implemented under the Contamination Assessment (CA).

2.0 BACKGROUND

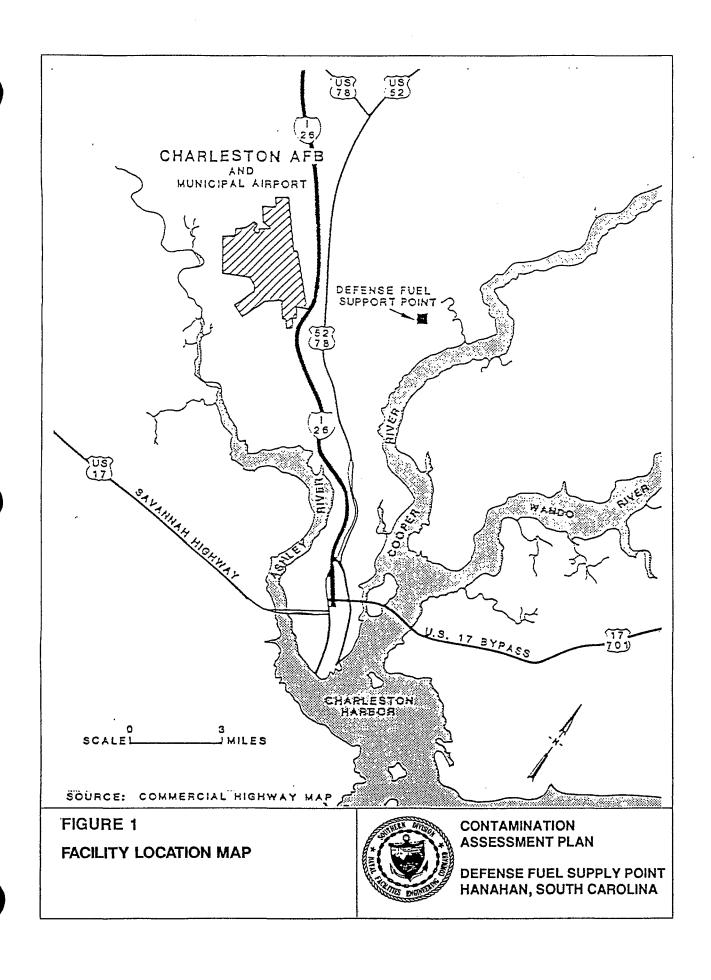
2.1 SITE DESCRIPTION. The DFSP site is located approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina (Figure 1). The site occupies approximately 36 acres just east of North Rhett Boulevard. Immediately north of the DFSP facility is a residential community called Gold Cup Springs Subdivision (Figure 2). The areas to the west and south of the site are comprised mainly of light industry. Immediately east of the site is a U.S. Army-Navy Reservation. The facility contains seven 70,000 barrel capacity aboveground storage tanks, truck loading stands, and several buildings. Each tank is constructed of welded steel with a floating roof and is surrounded by an earthen berm. The primary product handled at the facility is JP-4 jet turbine fuel.

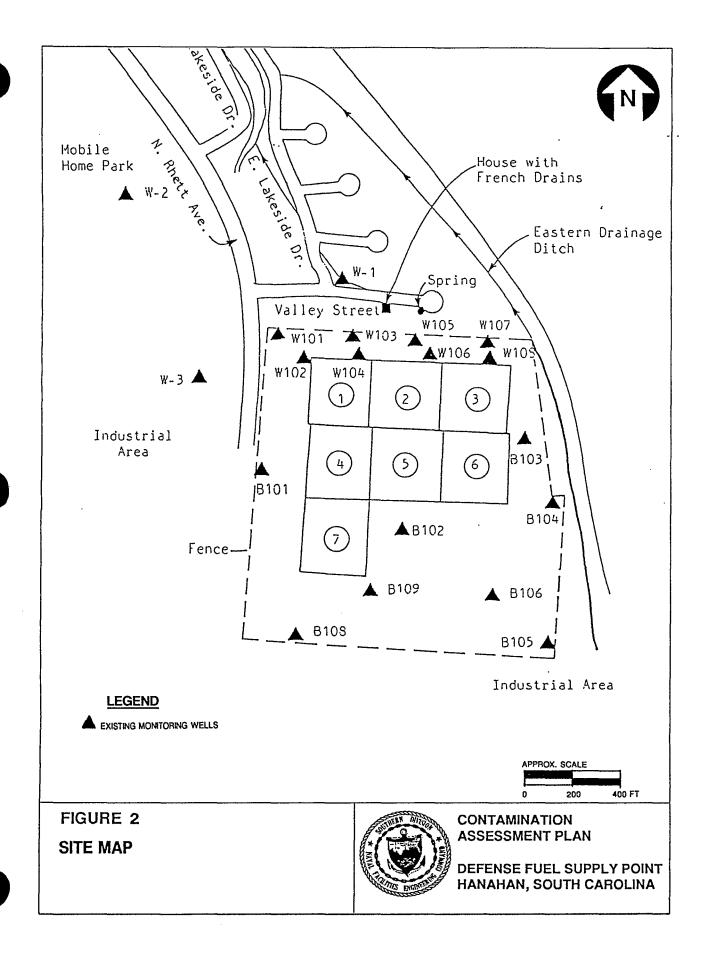
The DFSP facility is owned and operated by the Defense Logistics Agency, Alexandria, Virginia, and the facility property is owned by the U.S. Air Force. Environmental investigations and remedial activities at the site are being performed by SDIV.

2.2 SITE HISTORY. In September 1975, a leak developed in the bottom of storage tank No. 1 immediately after it had been cleaned and put back in service. Approximately 83,000 gallons of JP-4 jet fuel were lost before a water bottom was put in the tank. Leakage was confirmed to be the cause of the loss. The lost fuel reached the shallow, surficial aquifer and migrated northward into the Gold Cup Springs Subdivision, a subdivision of approximately 75 homes.

In November 1975, the U.S. Army Environmental Hygiene Agency (USAEHA) from Aberdeen Proving Ground, Maryland, was brought in to investigate the site. Monitoring wells were installed to delineate the contamination and a well point system was constructed in December 1975 to extract the fuel from the groundwater and soils. The well point system became impractical by January 1976. A collection ditch was built along the northern border of the site to collect the remaining fuel. A second well point system was installed in March 1976 and was operated until April 1976. It was estimated that approximately 25 percent of the lost fuel was recovered by these operations.

In June 1980, the Defense Fuel Support Center (DFSC) contracted Dames and Moore to conduct a field investigation and monitoring program to assess the extent of groundwater contamination at the DFSP facility and in the Gold Cup Springs Subdivision, north of the facility. Dames and Moore installed 17 monitoring wells and collected groundwater samples from these wells for pH, specific conductance, total organic carbon, oil and grease, and diethylene glycol monomethyl ether (a fuel system icing inhibitor) analyses. The study concluded that hydrocarbon-related contamination was present in minimal amounts and was dispersed around the site. Past fuel recovery, chemical and biological processes, and natural dilution had reduced groundwater contamination.





In 1985, samples from additional monitoring wells installed by Science Applications International Corporation and sampled by General Engineering Laboratories, revealed JP-4-related compounds, including benzene, ethyl benzene, toluene, and xylenes (BETX) in one of the off-site wells. In additional studies conducted by McClelland Engineers, Inc., in 1986 and RMT, Inc., in 1987, JP-4-related compounds were detected in the groundwater, surface water, soil, and sediment within the Gold Cup Springs Subdivision. In addition, air monitoring studies conducted by RMT, Inc., in 1987 identified some contamination of the air in subdivision homes and throughout the neighborhood.

In October 1987, ICF-Clements Associates, Inc., prepared a Risk Assessment for the DFSP facility. The results were that inhalation and ingestion of contamination associated with the facility, most notably benzene, could pose a potential cancer risk of greater than 1 in 1 million and that exposure to chemicals, while swimming in pools filled with contaminated groundwater, may result in significant risk. Exposure to noncarcinogens (most notably total xylenes) may also result in a hazard index greater than 1.

As a result of the investigations at the site, bioremediation was selected as the cleanup technique. The U.S. Geological Survey (USGS) is currently operating and monitoring the bioremediation system at the site.

In addition to the 83,000 gallon fuel leak at tank No. 1, other areas of the facility have been found to be contaminated with petroleum hydrocarbons. Small spills and leaks are the likely contributors of contamination in these areas. The USGS performed an initial site screening of the site using a passive soil gas survey in 1990. The USGS report concludes that an assessment of contamination delineation should be performed along the eastern and western parts of the facility.

2.3 HYDROGEOLOGY

<u>2.3.1 Regional Hydrogeology</u> The Charleston, South Carolina area is underlain by four water bearing zones. These zones include the surficial water table aquifer, the Tertiary Aquifer System, the Black Creek Aquifer, and the Middendorf Aquifer.

The Coastal Plain of South Carolina, which includes Charleston, consists of a series of complex, interbedded unconsolidated to partially consolidated sedimentary formations of Late Cretaceous to Quaternary age. Surficial sediments within the study area consist of a variable sequence of sand, silt, and clay with a basal conglomeratic layer containing phosphate nodules that are a part of the Ladson Formation. The formation averages about 30 feet in thickness. These sediments were deposited as a result of a series of sea level encroachments and recessions that occurred during the Pleistocene epoch (Siple, 1946.)

The surficial water table aquifer is contained within the unconsolidated sediments of the Ladson Formation. The aquifer is recharged largely by the infiltration of precipitation over the area. Locally, the aquifer may be recharged by seepage from the underlying Santee Limestone in areas where the Discharge from the surficial aquifer occurs Cooper Formation is absent. principally by evapotranspiration and through natural seepage to surface water bodies. Shallow wells account for only a small amount of discharge from this aquifer and vertical migration into underlying aquifers is limited by the Cooper Formation. Depth to the water table of the surficial aquifer ranges from 3 to 15 feet below land surface (bls) and generally reflects changes in the local topography. Well yields average approximately 85 gallons per minute (gpm) with reported transmissivities between 600 and 1,340 feet squared per day (ft²/day) (Park, 1985). The groundwater is commonly acidic and may contain high iron concentrations.

Unconformably underlying the Ladson Formation and forming the lower confining unit of the surficial aquifer and upper confining unit of the Tertiary Aquifer System is the Cooper Formation of Oligocene age. The Cooper Formation is a massive sandy, phosphatic limestone that is uniform in color and texture. The Cooper Formation requires only a few feet of thickness to effectively retard vertical groundwater flow.

Underlying the Cooper Formation and comprising the Tertiary Aquifer System are the Santee Limestone of Eocene age and the Black Mingo Formation of Paleocene age. The Santee Limestone consists of a creamy-white to gray, slightly glauconitic lime mudstone to marl. The unit ranges from 60 to 80 feet thick in the project area (Park, 1985). Wells tapping this unit yield between 200 and 500 gpm and are mostly under artesian conditions. The Tertiary Aquifer System is recharged by infiltration in updip outcrop zones inland of the project area. Groundwater flow in the aquifer is to the southeast under relatively flat regional hydraulic gradients (Aucott and Speiran, 1985). Excessive hardness and high iron and fluoride concentrations are common in the groundwater of the Santee Limestone. Brackish water can be found at the coastal margin of Charleston County.

The Black Mingo Formation underlies the Santee Limestone and is composed of limestone, green to gray argillaceous sand, and dark-gray to black clay. This formation is approximately 400 feet thick in the project area (Park, 1985). This formation is hydraulically connected to the Santee Limestone and is the lowest unit of the Tertiary Aquifer System. The sands of the Black Mingo Formation constitute the major water-bearing strata. Well yields average approximately 230 gpm. Transmissivities in this unit range from 500 to 3,700 $\rm ft^2/day$ and hydraulic conductivities range between 29 to 170 $\rm ft/day$ (Park, 1985).

Underlying the Black Mingo Formation approximately 700 feet below mean sea level (MSL) are the Peedee, Black Creek, and Middendorf Formations of Late Cretaceous

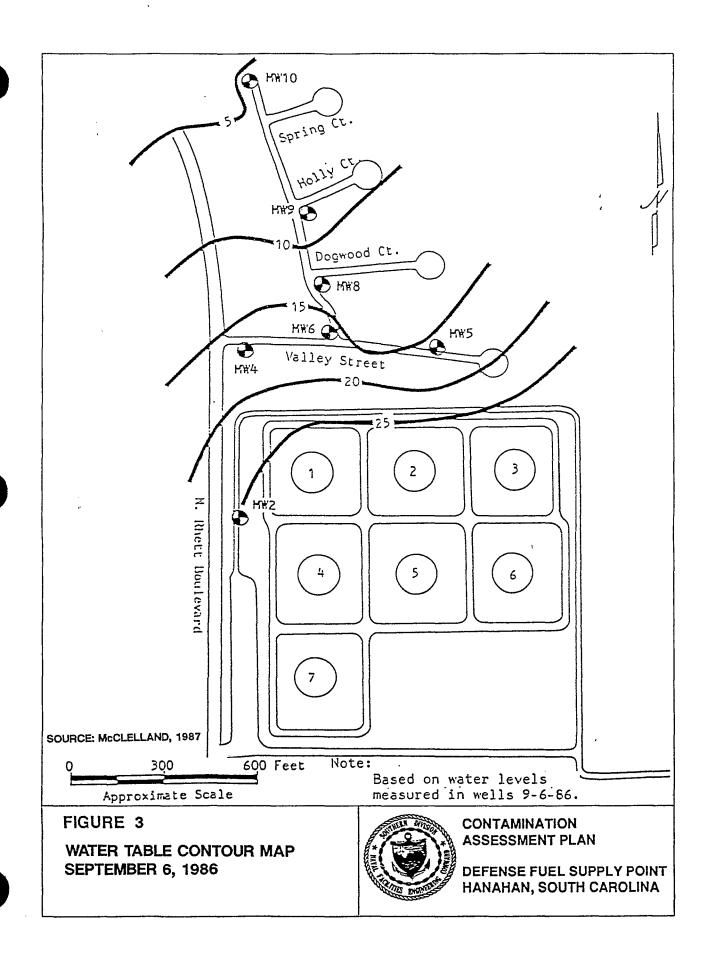
age. These formations consist of interbedded sand, silt, and clay with occasional limestone. Each of these formations is capable of producing groundwater under artesian pressure; however, the major water bearing zones are the Black Creek Aquifer in the Black Creek Formation and the Middendorf Aquifer in the Middendorf Formation.

The lower part of the Black Mingo Formation and the Peedee Formation contain sufficient clays and silts to form an effective vertical hydraulic barrier between the upper Tertiary Aquifer System and the lower Black Creek Aquifer. Another confining unit exists in the lower Black Creek Formation and upper Middendorf Formation to separate the Black Creek Aquifer from the Middendorf Aquifer. Hydraulic conductivity in the Black Creek Aquifer has been estimated at 2 to 59 feet/day with a storage coefficient of 10^{-4} (Park, 1985). Groundwater flow direction in the Black Creek Aquifer is to the east. The Middendorf Aquifer is the most productive of the two aquifers with groundwater flow to the east-northeast under a gentle regional hydraulic gradient (Aucott and Speiran, 1985). Both aquifers contain potable water; however, in some areas water quality may have excessive concentrations of dissolved sodium, bicarbonate, and fluoride.

The basement rock in the region is Triassic in age and occurs approximately 3,000 feet below MSL (Park, 1985).

2.3.2 Site Hydrogeology Soil boring and monitoring well data from previous studies indicate that the DFSP site is underlain by 25 to 38 feet of recent fill and fine sands with numerous clay and silt lenses and basal layers of phosphatic gravels of the Ladson Formation. This formation thins towards the north. The surficial aquifer is contained in these materials. Beneath the Ladson Formation and forming the base of the surficial aquifer is the homogeneous, dark green-gray calcareous clay and silt (marl) of the Cooper Formation. This formation is estimated to be 260 feet thick in this area and presents a very competent confining layer in the site area (Dames and Moore, 1982). The contact between the Ladson and Cooper Formations is undulatory and varies between 1 and 8 feet above MSL. Depth to the surficial aquifer water table ranged from 5 to 18 feet bls during previous investigations. Some of this variability is based on surface elevations; however, the data suggests that the water table fluctuated by as much as 7 feet at the site.

The general direction of groundwater flow in the surficial aquifer at the site is to the north-northwest. Localized groundwater flow directions at the site may be controlled by topography, with groundwater flow west of the DFSP site toward the west and groundwater flow just north of the DFSP site generally towards the centerline of the north-south valley through which East Lakeside Drive runs. Figure 3 illustrates a water table contour map from data collected on September 6, 1986. Calculations for hydraulic conductivity from monitoring wells at the site using the Hvorslev (1951) method range from 10^{-4} to 10^{-3} centimeters per second (cm/sec). An estimated seepage velocity at the DFSP site was calculated



as 8.5×10^{-5} cm/sec or 0.24 feet per day using an average hydraulic conductivity of 8.5×10^{-4} cm/sec, an average hydraulic gradient of 0.02, and an effective porosity of 0.20 (McClelland Engineers, 1987). It is believed that the discharge of groundwater by the numerous springs in the Gold Cup Springs Lake neighborhood into the ditch on E. Lakeside Drive, along with the routing of groundwater discharges by French drains installed by several residents on Valley Street, may significantly increase the rate of contaminant transport.

3.0 PROPOSED ASSESSMENT PLAN

It is proposed that a two-phase field investigation be undertaken to assess the suspected contaminant plumes along the eastern and western sides of the DFSP site. The phased approach is discussed in the following two sections. During both the Phase I and Phase II field investigations, the ABB-ES field leader will meet on-site or at SDIV with the SDIV Engineer-In-Charge (EIC) on a weekly basis to discuss the field investigation progress and findings.

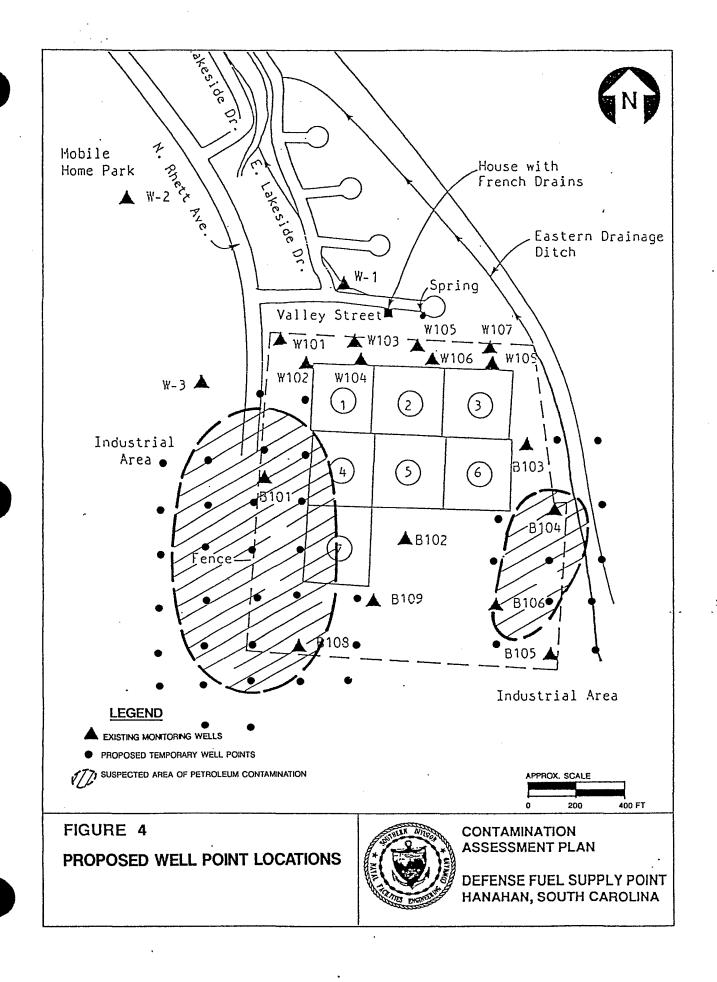
3.1 PHASE I FIELD INVESTIGATION. The purpose of the Phase I investigations is to assess the approximate horizontal extent of the contaminant plumes at the eastern and western sides of the site by obtaining groundwater samples from temporary wellpoints and soil samples from hand augered soil borings and screening these samples with a field gas chromatograph (groundwater) and organic vapor analyzer (soil). The information obtained during this field screening phase will assess the extent of the contaminant plumes and direct the placement of monitoring wells during the Phase II investigation.

Prior to the Phase I investigation, any necessary permits, off-site utility clearances, and right-of-way easements and private property access approvals will be obtained with the help of Navy personnel or their representatives. In addition, information on the location of potable water wells within a 1/4 mile radius of the site will be obtained from SDIV, DFSP, SCDHEC, and previous investigation reports.

The Phase I field investigation will consist of installing up to 40 temporary wellpoints along the western side of the DFSP site to assess the western contaminant plume. Up to 16 temporary wellpoints will be installed to assess the eastern contaminant plume. The locations of the proposed temporary wellpoints are shown on Figure 4. The wellpoints will be installed using a KV Macho System or equivalent.

Groundwater samples will be collected at each wellpoint location and screened for the presence of the petroleum contamination constituents benzene, ethyl benzene, toluene, and xylenes (BETX) using a field gas chromatograph (GC). In addition, up to 20 shallow soil borings will be conducted using a hand auger where possible at both the eastern and western contaminated areas to assess soil contamination and local lithology. Soils will be classified in accordance with the Unified Soil Classification System. Soil samples will be collected from each soil boring and placed in 16-ounce glass jars. The soil samples will be screened for petroleum contamination by head space analysis using an organic vapor analyzer (OVA) equipped with a flame ionization detector (FID).

3.2 PHASE II FIELD INVESTIGATION. The purpose of the Phase II field investigation is to further assess the horizontal extent of the petroleum contamination in the eastern and western areas of the DFSP facility, assess the vertical extent of the petroleum contamination, and characterize the contamination. This will be accomplished through the drilling of soil borings in areas where hand augering



could not take place to collect soil samples for OVA screening; the installation of permanent groundwater monitoring wells; the collection of groundwater samples from the monitoring wells for laboratory analysis of jet fuel constituents; surveying of the elevations of the monitoring wells to determine aquifer flow direction and gradient; and aquifer testing on select monitoring wells to estimate aquifer characteristics.

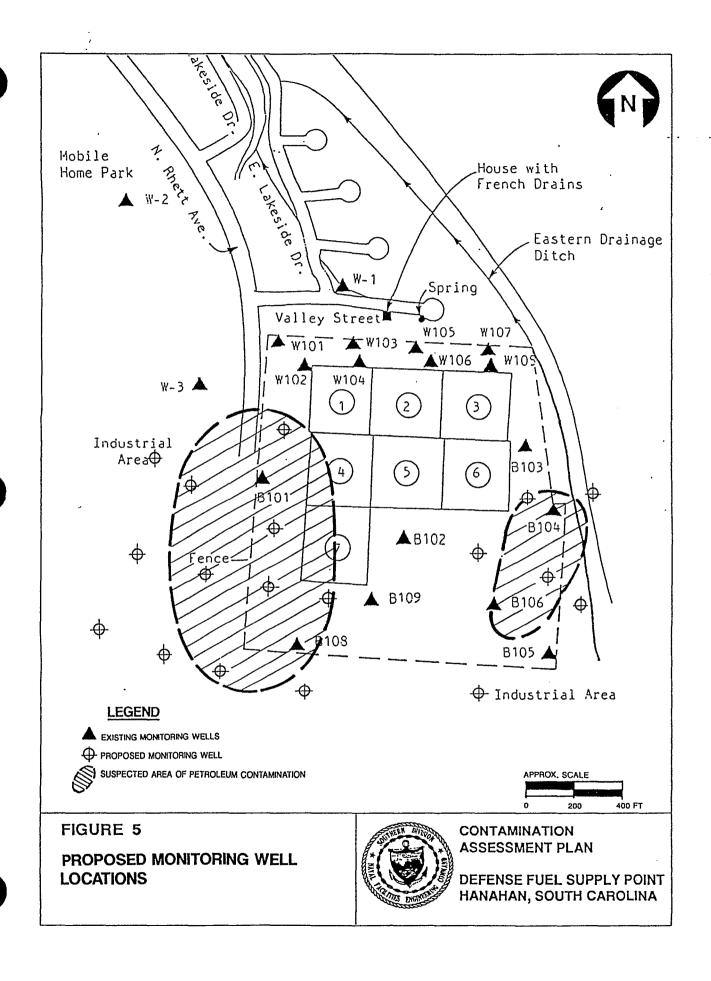
During the Phase II field investigation, 18 shallow monitoring wells (up to 15 feet in depth) will be installed at the site to assess the eastern and western contaminant plumes. The location of the proposed monitoring wells is shown on Figure 5; however, exact well placement will depend on the results of the Phase I investigation. All monitoring wells will be constructed of 2-inch inside diameter (ID), flush threaded Schedule 40 polyvinyl chloride (PVC) screen and riser. The well screen will be comprised of a 10 foot section of 0.010-inch slotted screen. Well screens will be set such that a minimum of 2 feet of screen will be above the water table. Depth to the water table in existing wells will be measured to determine the depth interval for the well screen. The remainder of the well casing will consist of solid riser pipe to the ground surface. Total well length and depth for the shallow monitoring wells is not expected to exceed 15 feet bls.

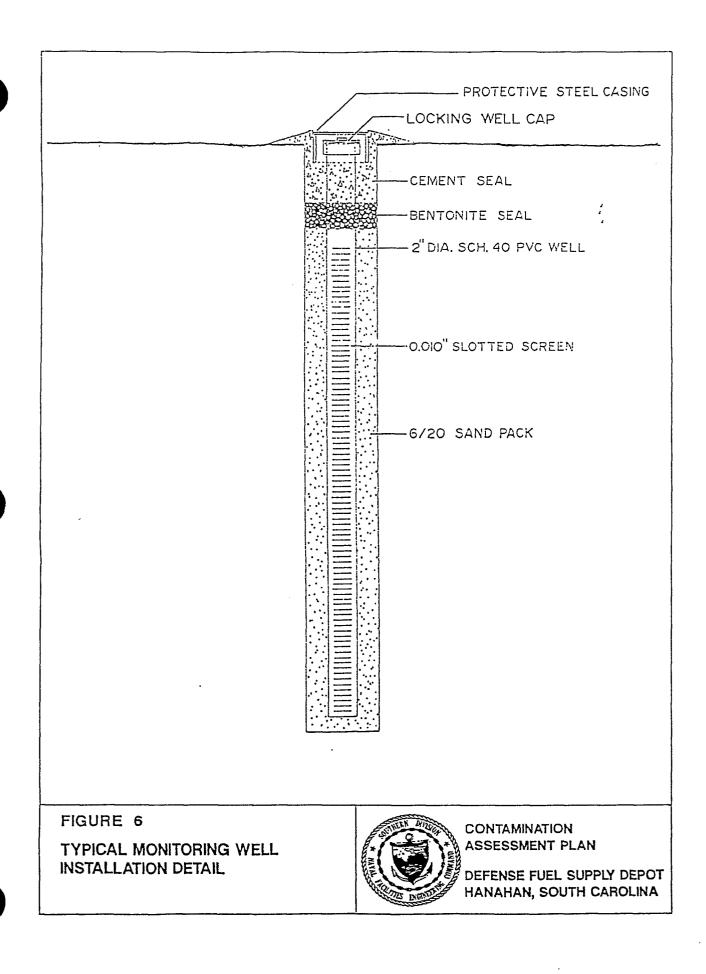
The well annulus will be filter packed with No. 6-20 sand or an acceptable grade of sand to at least 1 foot above the well screen. A 2-foot bentonite seal will be placed above the sand pack with the remaining annular space grouted to the surface. Wells will be flush mounted with the ground surface and will consist of a locking protective cap and a steel subsurface vault set in the pavement around each well riser pipe. Typical construction details for the proposed monitoring wells are provided in Figure 6.

In addition to the monitoring wells, up to 15 shallow soil borings will be advanced with a drill rig in those areas where it was not possible to perform the Phase I manual soil borings.

Upon completion of the monitoring well installation, the wells will be developed using a centrifugal pump until the groundwater is sediment free or as clear as the aquifer will allow in a reasonable amount of time. The measuring point for groundwater elevation on the PVC riser pipe and the land surface adjacent to each monitoring well will be surveyed to within \pm 0.01 foot based on an arbitrary reference elevation of 50 feet.

Groundwater samples will be collected from the newly installed monitoring wells in addition to the 11 existing wells at the site and analyzed for jet fuel constituents (U.S. Environmental Protection Agency Methods (EPA) 602, 610, 239.2, and 418.1). At the western contamination area 16 groundwater samples will be collected and at the eastern area, 13 groundwater samples will be collected. In addition, three duplicate samples; two equipment blanks; one field blank; and five trip blanks will be obtained.





Groundwater samples will be shipped via overnight carrier to an approved analytical laboratory. Sampling and the subsequent analytical program will comply with ABB-ES's Comprehensive Quality Assurance Plan (ComQAP).

During the Phase I and II field investigations, ABB-ES personnel and their subcontractors will coordinate efforts with site personnel to dispose of contaminated fluids and soils. ABB-ES and their subcontractors will place any contaminated soils on plastic sheeting in an area approved by the facility manager. The contaminated soil will be laid out in 6-inch deep layers and allowed to aerate and be exposed to sunlight. The soils will be covered with plastic sheeting in the event of a rainstorm. ABB-ES will till the soils every other day to accelerate the aeration process. Any contaminated fluids will be transported and deposited in a train tanker car that is kept at the facility for the purpose of disposal of waste fluids. It will be the Navy's responsibility to dispose of any hazardous waste that may be generated during this project.

3.3 PREPARATION OF REPORTS. Upon completion of the field investigations and receipt of the analytical laboratory results of the groundwater samples, draft, 100 percent complete, and final Contamination Assessment Reports (CARs) will be prepared and submitted to SDIV for review and approval. The reports will discuss site background information, site conditions, findings, and recommendations for the eastern and western areas of the DFSP site. Recommendations shall be made as to the need for any follow-up reports. Site location maps; locations of soil borings, wellpoints, and monitoring wells; groundwater contour maps; and contamination delineation maps will be included with the reports.

Based on the findings, conclusions, and recommendations of the final CAR, draft, 90 percent complete, 100 percent complete, and final follow-up reports will be prepared for the two areas of concern. The reports shall be either No Further Action Proposals (NOFAP), Monitoring Only Proposals (MOP), or Preliminary Remedial Action Plans (PRAP).

If a PRAP is developed for the DFSP site it will include the following items:

- summary sheet of the Contamination Assessment Report,
- general discussion of the technical and economic feasibility of the selected remedial system and why it was chosen over other remedial options,
- general discussion of the rationale of the selected system,
- comparison of contaminant levels found with existing State and EPA cleanup criteria in tabular format,
- disposition and expected contamination concentrations in any effluent from the proposed cleanup method,

- cost estimates and schedules for the design phase, construction/startup phase, and the operation phase,
- designation of monitoring wells and proposed methodology for verifying accomplishment of PRAP goals (cleanup levels),
- · general discussion of the treatment of contaminated soils, and
- recommendations for conducting pilot studies and obtaining additional information.

The PRAPs will compare from two to four remedial technologies for cleanup of both groundwater and soil and the selected technology will be justified based on technical and economic feasibility. A conceptual design and rationale for the design will be provided for the selected remedial technology.

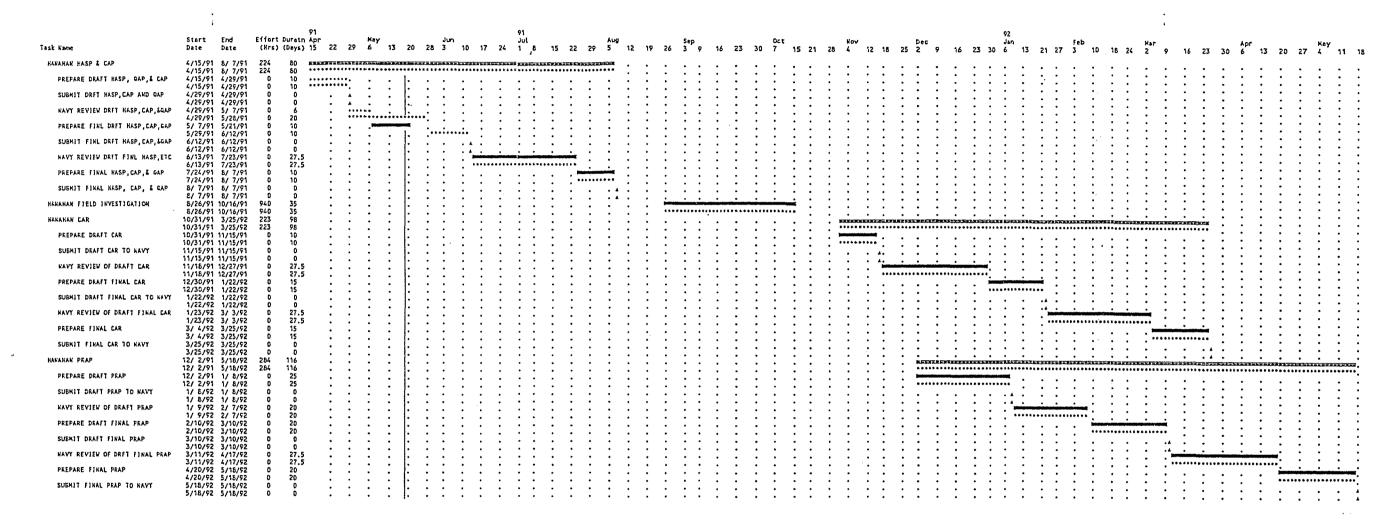
It is our understanding that Southern Division will develop performance specifications for construction that are based on the PRAP and the CAR. While these documents will provide some of the information necessary to develop performance specifications, neither document will be biddable. Additional site information that may be needed to develop the performance specifications but not included in this scope is as follows:

- · horizontal and vertical survey data,
- · locations of existing utilities, and
- location and availability amount of electric power.

4.0 SCHEDULE

A projected schedule to complete the Contamination Assessment field investigation is approximately 7 weeks. The field investigation is tentatively scheduled to begin the week of August 26, 1991. Upon completion of the field investigation, approximately 3 weeks will be required before receipt of the laboratory analyses of the groundwater samples that were collected during the investigation. A draft Contamination Assessment Report will be prepared and submitted to SDIV by November 15, 1991. If proper time schedules for report review are followed, a draft follow-up report has been scheduled to be delivered to SDIV by January 8, 1992. A Gantt Chart outlining the project schedule is presented as Figure 7.

SCHEDULE



LEGEND

Detail Task

(Progress)

(Progress)

(Slack)

(Slack)

Progress shows Percent Achieved on Actual

Scale: 8 hours per character

Scale: 8 hours per character

FIGURE 7

DFSP HANAHAN PROJECT GANTT CHART



CONTAMINATION ASSESSMENT PLAN

DEFENSE FUEL SUPPLY POINT HANAHAN, SOUTH CAROLINA

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SITE-SPECIFIC HEALTH AND SAFETY PLAN FOR CONTAMINATION ASSESSMENT INVESTIGATION

DEFENSE FUEL SUPPLY POINT HANAHAN, SOUTH CAROLINA

CTO NO.: 00010

Contract Number N62467-89-D-0317

Prepared by:

ABB Environmental Services, Inc. 2571 Executive Center Circle East Tallahassee, FL 32301-5001

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, South Carolina 29411-0068

Ted Campbell, Engineer-In-Charge

MAY 1991

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REFERENCES

The following chapters of the Comprehensive Long-term Environmental Action Navy (CLEAN) Program District I Generic HASP are applicable for the work anticipated at the site:

✓ 2.0	AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL
✓ 3.0	TRAINING PROGRAM
✓ 4.0	MEDICAL SURVEILLANCE PROGRAM
✓ 5.0	ENGINEERING CONTROLS
✓ 6.0	PERSONAL PROTECTIVE LEVEL DETERMINATION
<u>✓</u> 7.0	MONITORING EQUIPMENT
8.0	ZONATION
√ 9.0	WORK PRACTICES
10.0	CONFINED SPACE ENTRY PROCEDURES
11.0	EXCAVATION AND TRENCHING
✓ 12.0	TEMPERATURE EXTREMES HEAT STRESS COLD STRESS
✓ 13.0	DECONTAMINATION
<u>✓</u> 14.0	EMERGENCY PLANNING
<u>✓</u> 15.0	HEALTH AND SAFETY FORMS AND DATA SHEETS HEALTH AND SAFETY AUDIT FORM ACCIDENT REPORT FORM HEALTH AND SAFETY OFFICER (HSO) CHECKLIST FOR FIELD OPERATIONS MATERIAL SAFETY DATA SHEETS LIQUI-NOX ETHYL ALCOHOL (denatured) TRISODIUM PHOSPHATE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) POSTER DAILY HEALTH AND SAFETY AUDIT FORM

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1.0 GENERAL

1.1 SCOPE AND PURPOSE. This Health and Safety Plan (HASP) has been prepared in conformance with the Navy CLEAN Program District I (CLEAN) HASP and is intended to meet the requirements of 29 Code of Federal Regulations (CFR) 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all ABB-ES personnel, contractor personnel, or third parties entering the site.

1.2 PROJECT PERSONNEL.

- 1.2.1 Project Manager The project manager (PM) is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP, the necessary resources to meet requirements of this HASP, the coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements, and the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project.
- 1.2.2 General Site Supervisor The General Site Supervisor is either the PM or the PM's designee who is on-site and vested with the authority by the PM to carry out day-to-day site operations, including interfacing with the site Health and Safety Officer (HSO).
- 1.2.3 Health and Safety Officer The HSO for this project has been designated by the PM with concurrence of the Health and Safety Supervisor (HSS) or Health and Safety Manager (HSM). The HSO will have at least an indirect line of reporting to the HSM through the HSS for the duration of his/her assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the CLEAN HASP. The HSO will investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting an ABB-ES site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.
- 1.3 TRAINING. Training is defined under the CLEAN HASP, and all personnel entering potentially contaminated areas of this site must meet the requirements of 29 CFR 1910.120. Personnel without the required training will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 3.0 of the CLEAN HASP for further information.

1.4 MEDICAL SURVEILLANCE. All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the CLEAN HASP. Personnel who have not received medical clearance will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 4.0 of the CLEAN HASP for further information.

2.0 SITE CHARACTERIZATION AND ANALYSIS

- 2.1 SITE NAME, LOCATION, AND SIZE. The Defense Fuel Supply Point (DFSP) site is located just east of North Rhett Boulevard approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina. The facility occupies approximately 48 acres.
- 2.2 SITE HISTORY AND LAYOUT. In September 1975, a leak developed in the bottom of one of seven 70,000 barrel capacity aboveground storage tanks. Approximately 83,000 gallons of JP-4 jet fuel was lost. The initial recovery operation recovered approximately 25 percent of the lost fuel. This leak occurred along the northern boundary of the property. Subsequent investigations from 1979 to 1990 indicated that petroleum contaminant plumes may exist along the eastern and western boundaries of the facility as a result of past spills and leaks.
- 2.3 SCOPE OF WORK (WORK PLAN). ABB-ES will conduct a contamination assessment along the eastern and western boundaries of the facility. The assessment will include shallow soil borings, collection of groundwater samples from temporary wellpoints, and the installation and sampling of permanent monitoring wells. The work will be conducted in Level D protective wear.

3.0 TASK ANALYSIS

3.1 TASK ONE.

- <u>3.1.1 Hazardous Substances</u> The contaminants of concern known or suspected to be present on-site, along with any established exposure limits for those substances are listed in Table 3-1.
- 3.1.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered at the site.
- 3.1.2.1 Health Hazards Contaminants to which personnel may be exposed are gasoline and diesel fuel and their constituents. The primary constituents of gasoline and diesel fuel that represent potential health hazards are described below and summarized in Table 3-1.

BENZENE is a watery, colorless liquid with a pleasant aromatic odor. It is a moderate irritant in small amounts both as a gas and as a liquid. If inhaled in large amounts it attacks the central nervous system, possibly resulting in coma and/or respiratory arrest. Chronic poisoning causes leukemia.

ETHYL BENZENE is a colorless aromatic liquid. It is a moderate skin irritant in gaseous form. Inhalation of high concentrations of the gas may cause temporary irritation of the nose, dizziness, and depression. The liquid form can blister the skin if not washed off immediately.

TOLUENE is a watery, colorless liquid with a pleasant aromatic odor. It is a mild skin irritant. Inhalation of high concentrations of the gas can cause temporary smarting of the eyes or irritation of the respiratory system. If the liquid form is allowed to remain on the skin for a long period of time, smarting and reddening of the skin may occur. Ingestion or aspiration of the liquid causes depressed respiration and pulmonary edema, and can result in kidney or liver damage.

XYLENE is a colorless, watery liquid with a sweet odor. It is a moderate skin irritant. When present as a gas in high concentrations, it can cause temporary slight smarting of the eyes or irritation of the respiratory system, headache, and dizziness. The liquid form may cause smarting or reddening of the skin if not washed off immediately. If the liquid is aspirated into the lungs it can result in severe coughing, distress, and rapidly developing pulmonary edema. If ingested, nausea, vomiting, cramps, headache, and coma can occur and may be fatal. Ingestion may also result in kidney and liver damage.

POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs), for the purposes of this plan and study, include those listed as parameters for USEPA Method 610. Some of the more notable PAHs from this method include acenaphthene, anthracene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene.

Table 3-1 Contaminants of Concern

Health and Safety Plan Defense Fuel Supply Point Hanahan, South Carolina

Chemical	Approximate odor threshold (ppm)	Permissible Exposure Limits (ppm)	Threshold Limit Value (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Benzene	4.7	1 .	1	Colorless liquid, pleasant aromatic odor.	Moderate skin irritant.	Inhalation of large amounts at- tacks central nervous system (CNS); chronic poisoning causes leukemia.
Ethyl benzene	140	100	100	Colorless liquid, aromatic odor.	Moderate skin irri- tant.	Liquid blisters skin, inhalation results in dizziness, depression.
Toluene	0.17	100	100	Colorless liquid, pleasant aromatic odor.	Mild skin irritent,	Ingestion or aspiration can cause pulmonery edema, depressed respiration.
Xylene	0.05	100	100	Colorless liquid, aromatic odor,	Moderate skin irritant.	Inhalation causes headache and dizziness; vapors irritate eyes; can be fatal if ingested.
Naphthalene		10	10	Colorless to brown solid with an odor of mothballs	Moderate skin irritant	Inhalation causes headache and confusion; vapors irritate eyes.
Lead				Soft, ductile, gray, metal, soluble in water containing a weak acid.		Lead poisoning may cause fa- tigue, anemia, abdominal pains, and neurological damage.

Notes: ppm = parts per million.

In addition, care will be taken to avoid contact with the base neutral compounds that include naphthalene, phenanthrene, fluorene, and anthracene. Details of these compounds are listed in Section 4.0.

All activities at this site will be conducted in unconfined areas. This will minimize the chances of exposure of on-site personnel to either high vapor concentrations or strong liquid concentrations of any of the substances described above.

3.1.2.2 Safety Hazards Safety hazards include those hazards which personnel may be exposed to that are unrelated to hazardous wastes. These include hazards such as heat stress, operation and presence around heavy equipment, lifting of objects, vehicle traffic, and snake bites. Extreme caution should be exhibited by all personnel while conducting work around drill rigs, backhoes, and other heavy equipment. During hot days, personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress.

Lifting of heavy objects should be done with caution. Personnel should assist one another with moving heavy objects or use the appropriate equipment to accomplish these tasks. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes.

Hanahan.HSP 05.91 (CLEAN.01)

- Power substations, powerlines, underground utilities, and underground pipelines are to be avoided during drilling operations. Information on underground utilities and scheduling of the field work at the facility will be coordinated with Mr. Don Matthews, the Quality Assurance Supervisor at DFSP Hanahan.
- 3.1.2.3 Conclusions and Risk Assessment Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be <u>low</u>, assuming appropriate health and safety practices are maintained.
- 3.1.3 Protective Measures The following are the protective measures that will be used at the site.
- 3.1.3.1 Engineering Controls Whenever needed, engineering controls (i.e., fans to blow volatilized chemicals away from the work area) will be used.
- 3.1.3.2 Levels of Protection A level D work uniform will be used at the site. Level D Protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.
- <u>3.1.4 Monitoring</u> It is intended that real time monitoring instrumentation will be used to monitor the work environment in order to ensure the appropriate level of protection for the site team.
- 3.1.4.1 Air Sampling To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

1. Foxboro Organic Vapor Analyzer Model 128 (OVA)

If the OVA detects a steady measurable quantity of organic vapors greater than 5 ppm (above background conditions) in the breathing zone, the field team will withdraw from the site until health and safety conditions at the site are reevaluated.

3.1.4.2 Personal Monitoring Personal monitoring will be undertaken to characterize the personal exposure of high risk employees to the hazardous substances they may encounter on-site. Personal monitoring will be conducted on a representative basis. Personnel who are represented by the sampling will be noted in field logs.

The following personal monitoring equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the maintenance and calibration of the equipment.

1. Thermoluminescent Dosimetry Body Badge

Common Synon Brizol Benzole	Common Synonyms Watery liquid Colorless Gasoline-like odor Serzole Floats on water, Flammable, irritating vapor is produced. Freezing point is 42°F.		6. FIRE HAZARDS 6.1 Flash Point: 12°F C.C. 6.2 Flammable Limits in Air: 1.3%-7.9% 6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U-V-W
Avoic contact with liquid and vapor. Keep people away, wear gopgles and self-contained breathing apparatus. Shut off ignition sources and call fire dependent. Stop descharge if possible. Stay upwind and use water spray to "Anock down" vapor. Isolate and remove discharged material. Notify local health and poliution control apencies.			Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations; Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation:
FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear googles and self-contained breathing apparatus. Exinguish with dry chemical, foam, or carbon dioxide Water may be melective on fire. Cool exposed containers with water.		6.7 Ignition Temperature: 1097/F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 6.0 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stotchlometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	Category Rating Fire .	
Exposure	CALL FOR MEDICAL AID. VAPOR irritating to eyes, nose and throat. It inhalled, will cause headache, difficult breathing, or loss of consciousness. Move to test are if the peating has stopped, give anticipal respiration if the earning has stopped, give anticipal respiration if the earning is difficult, give origin. LIOUID Instaing to skin and eyes. Harmful if swallowed. Remove contemptated clothing and shoes. Flush effected areas with pently of water. If the EYES, hold eyellost open and flush with plenty of water. If SWALLOWED and within its CONSCIOUS, have victim drink water or milk.		7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not perinent 7.5 Polymerization: Not perinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32	Restricts Electricity Cher Chemicals 2 Water
Water Poliution HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials Notify operators of nearby water intakes.			12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Lroud 12.2 Molecular Weight: 76.11 12.3 Boiling Point at 1 atm: 176°F = 80.1°C = 283.3°K 12.4 Freezing Point	
		LABEL Category: Flammable liquid Cleas: 3	8. WATER POLLUTION 8.1 Aquatic Toxicity: 5 ppm/6 hr/minnow/lethal/distilled water 20 ppm/24 hr/sunfish/TL_/tap water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days	42.0°F = 5.5°C = 278.7°K 12.5 Critical Temperature: 552.0°F = 265.9°C = 562.1°K 12.6 Critical Pressure: 710 psia = 46.2° atm = '4.89 MN/m² 12.7 Specific Gravity: C.679 at 20°C (liquid) 12.8 Liquid Surface Tension: 26.9 dynes/cm = 0.0289 N/m at 20°C
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class; Aromatic Hydrocarbon 3.2 Formula; CaHe 3.3 IMO/UN Designation: 3.2/1114 3.4 DOT ID No.: 1114 3.5 CAS Registry No.: 71-43-2		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Coloriess 4.3 Odor: Aromatic, rether pleasant aromatic odor: characteristic odor	8.4 Food Chain Concentration Potential: None	12.9 Liquid Water Interscial Tension: \$5.0 dynes/cm = 0.035 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 2.7 12.11 Ratio of Specific Heats of Vapor (Gas): 1.061 12.12 Latent Heat of Vaporization: 169 Blu//b = \$4.1 cal/g = 5.54 X 10³ J/kg 12.13 Heat of Combustion: —17,460 Blu//b = —9595 cal/g = —406 0 X 10³ J/kg
hydrocarbor hydrocarbor hydrocarbor Symptoms Fe headache, b 5.3 Treatment of contaminate INHALATIOL stopped, sta Threahold Lin 5.5 Short Term in 5.6 Toxicity by in 5.7 Late Toxicity: Vapor (Gas) I of eyes or r	lective Equipment: Hyd h-insoluble rubber or plat- h-insoluble apron such a olitowing Exposure: Diz- preathlessness, chest oc Exposure: SKIN: flush- do clothing and wash ski- N: remove from exposur- nt resuscitation, adminis- nit Value: 10 ppm habiation Limits: 75 ppr ogestion: Grade 3; LDso- t-Leukenia rritant Characteristica: espiratory system. The 6	ziness, excitation, pallor, followed by flushing, weakness, onstriction. Coma and possible death. with water followed by soap and water, remove in, EYES; flush with plenty of water until irritation subsides, re immediately. Call a physician. If breathing is irregular or ster crygen. If or 30 min. If present in high concentrations, vapors may cause irritation	9. SHIPPING INFORMATION 9.1 Grades of Purity: Industrial pure99+% Thiophene-free99+% Nitration99-% Industrial 90%85+% Resgent99+% 9.2 Storage Temperature: Open 9.3 Ihert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum	12.14 Heat of Decomposition: Not perinent 12.15 Heat of Solution: Not perinent 12.16 Heat of Polymerization: Not perinent 12.25 Heat of Fusion: 30.45 cal/g 12.26 Limiting Value: Date not available 12.27 Reid Vapor Pressure: 3.22 psia
	y cause smarting and re- old: 4.68 ppm	• • • • • • • • • • • • • • • • • • • •	NC	DTES

ETHYLBENZENE

Common Syno Phenylethane EB	Common Synonyma Liquid Coloriess Sweet, gasoline-like odor Phenyletriane EB Floats on water, Flammable, irritating vapor is produced.		odor 6.1 Flash Point: 80°F O.C.: 59°F C.C. 6.2 Flammable Limits in Air. 1.0%-6.7% 6.3 Fire Extinguishing Agents: Fosm (most effective), water fog, carbon dioxide or		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U	
Avon cortact with flourd and vapor freet people away west pages self-contained breathing apparatus, and rubt including gloves) Shull of ignition sources and call fire department Stop distribution and use water spray to "knock down" vapor, lacters are remove distribution control agencies. FLAMMABLE Plashback along vapor trail may occur, Vapor post, capped, tipigned to an enclosed including gloves). Fine Fire Fire Cool exposed containers with hater.		caratios, and rubber overciciting riment is down' vapor. oricles. may occur, dig an enclosed area, and rubber overciciting is, form, or carbon diction.	6.5	ory chemical. Fire Extingulating Apents Not to be Used: Not pertinent Special Hazzards of Combustion Products: Irritating vapors are generated when heated. Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back. Ignition Temperature: 850°F Electrical Hazzard: Not pertinent Burning Rate: 5.6 mm/min. Adlabatic Flame Temperature: Data Not Available	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulationa:	
Exposure	VAPOR Irritating to eyes, nose and throat. It is the state of the stat			(Continued) 7. CHEMICAL REACTIVITY Reactivity With Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not perinent Polymerization: Not perinent Inhibitor of Polymerization: Not perinent Motar Ratio (Reactant to Product): Data Not Available Reactivity Group: 32	Human Toxicity	
(See Respons Mechanical Should be r	Fouling to shoreline. May be dangerous if it enter Notify tocal nearth and wide Notify operators of nearby INSE TO DISCHARGE a Mathods Handbook) containment	de officials.	8.2 8.3	8. WATER POLLUTION Aquatic Toxicity: 29 ppm/96 hr/bluegiii/TL _m /fresh water Waterfowl Toxicity: Data not available Biological Oxygen Demand (BOD): 2.8% (theor.), 5 days Food Chain Concentration Potential: None	12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 106.17 12.3 Boiling Point at 1 atm: 277.2°F = 136.2°C = 409.4°K 12.4 Freezing Point: —139°F = —95°C = 178°K 12.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K 12.6 Critical Pressure: 529 psis = 35.6 atm = 3.61 MN/m² 12.7 Spectfic Gravity: 0.867 at 20°C (fiquid) 12.8 Liquid Surface Tension: 22.2 dynes/cm = 0.0282 N/m at 20°C	
3. CHEM 3.1 CG Compatible hydrocarbor 3.2 Formula: CeHi 3.3 IMO/UN Deelg 3.4 DOT ID No.2 1' 3.5 CAS Registry	n CH+CH+ nation: 3.3/1175 175	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic			12.9 Liquid Water Interiocial Tension: 35.48 oynes/cm = 0.03548 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity; Not pertinent 12.11 Ratio of Specific Hests of Vapor (Gas): 1.071 12.12 Latent Hest of Vaporization: 144 Btu/lb = 80.1 cal/g =	
5.2 Symptoms For Moderate in 5.3 Treatment of warm and of INGESTION chemical programmer of the state of the s	sective Equipment: Self-contain bilowing Exposure: inhalation of ritation of eye with comeal injur- Exposure: InhALATION: if if a usel, and get medical help pron i: induce vomiting only upon phy seumonitis. SKIN AND EYES: pr dical attention; remove and was nit Value: 100 ppm shalation Limits: 200 ppm for 3 spestion; Grade 2; LDs = 0.5 Data not available ritlant Characteristics: Vapors nechtrations unpleasant. The ef of Intriant Characteristics: Cau	to 5 g/kg (rat) cause moderate irritation such that personnel will fect is temporary, ses smarting of the skin and first-degree burns on	9.2 9.3	9. SHIPPING INFORMATION Grades of Purity: Research grade: 99.95%; pure grade: 99.5%; technical grade: 99.0% Storage Temperature: Ambient Inert Atmosphere: No requirement Venting: Open (flame arrester) or pressure-vacuum	3.35 X 10 ³ J/kg 12.13 Heat of Combustion: —17,780 Btu/lb = —9877 cal/g = —413.5 X 10 ³ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data Not Available 12.26 Limiting Value: Date Not Available 12.27 Reid Vapor Pressure: 0.4 psia	
shori exposure; may cause secondary burns on long exposure. 5.10 Odor Threshold: 140 ppm 5.11 IDLH Value: 2,000 ppm				6. FIRE MAZAI Stolchiometric Air to Fuel Ratio: Data Not A Flame Temperature: Data Not Available	•	

ETHYLENE DIBROMIDE

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	Common Synon 1, 2-Dibromoethane Ethylene bromide Bromofume sym-Dibromoethane Dow-fume 40, W-10, V Glycol dibromde	Sinks in water. Po	Colorless Sweel odor sisonous vapor is produced, point is 50°F.	6. FIRE HAZARDS 6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: Not flamma 6.3 Fire Extinguishing Agents: Not peril 6.4 Fire Extinguishing Agents Not to but be in Not perilent	nent
	Avoid contact	oe if possible. Keep people awit of with load and vapor, remove discharged material, health and pollution control age		Special Hazards of Combustion Products: Decomposition gases ar send initiating. Sehavior in Fire: Decomposes into the irritating gases. Feacts with hot me such as aluminum and magnesium.	oxic ORM-A ORM-A 11.2 Ocde of Federal Regulations: ORM-A 11.2 NAS Hazard Rating for Bulk Water Transportation:
	Not flammable. POISONOUS GASES ARE PRODUCED WHEN HEATED. West opopies, self-contained preating apparatus, and tubber overciciting (including gloves). Cost exposed containers with water. CALL FOR MEDICAL AID. VAPOR POISONOUS IF INHALED. Imasing to eyes, nose and throat. Move to fresh air. If the breathing has skroped, give artificial respiration. If breathing has skroped, give artificial respiration. If the breathing has skroped, give artificial respiration. If the breathing has skroped, give artificial respiration. If the string is chiculic give oxygen. LIOUID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. Imasing to skin and eyes. Imasing to skin and eyes. First street great with bearty of water. If it is EVES, hold eyelids oper and flush with plents of water, If SWALLOWED and victim is CONSCIOUS, have victim drink water of milk.			6.7 Ignition Temperature: Not flammable 6.8 Electrical Hazard: Not perinent 6.9 Burning Rate: Not flammable 6.10 Adlabatic Flame Temperature: Date Not Available 6.11 Stolchiometric Air to Fuel Ratio: Date Not Available 6.12 Flame Temperature: Data Not Availa	Fire
				7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: 1 reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Motar Ratio (Reactant to Product): Data Not Available 7.8 Reactivity Group: 36	Reactivity Other Chemicals
)	Water Poliution HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Neary local health and wildlife officials. holdy operators of nearby water miskes.				12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 167.66 12.3 Boiling Point at 1 atm: 266°F = 13°C = 404°K 12.4 Freazing Point
	(See Response Should be re	NSE TO DISCHARGE Methods Handbook) moved d physical treatment	LABEL Catepory: None Class: Not pertinent	8. WATER POLLUTION 8.1 Aquatic Toxicity: 18 mg/1/48 hr/bluegili/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Date not available 8.4 Food Chain Concentration Potential: None	12.8 Liquid Surface Tension: 36.75 dynes/cm = 0.03675 N/m at
	3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Hologenated hydrocarbon 3.2 Formula: BrCht-Chi-Br 3.3 IMO/UN Designation: 6.1/1605 3.4 DOT 10 No.: 1605 3.5 CAS Registry No.: 106-93-4		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Coloriess 4.3 Odor: Mildly sweet; like chloroform		36.54 dynes/cm = 0.03654 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity; Not pertinent 12.11 Riztlo of Specific Heats of Vapor (Gas): 1.109 12.12 Latent Heat of Vaporization: 62.1 Btu/lb = 45.6 cal/g = 1.91 X 10 ⁴ J/kg
	5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Canister type mask or self-contained air mask; neoprene gloves; chemical safety goggles. 5.2 Symptoms Following Exposure: Local inflammation, bisters and ulcers on skin; imitation in lungs and organic injury to liver and kidneys; may be absorbed through skin. 5.3 Treatment of Exposure: Remove from exposure. Remove contaminated clothing. Wash skin with soap and water, Flush eyes with plenty of water, Consult physician. 5.4 Threshold Limit Value: 2 ppm 5.5 Short Term Inhalation Limits: 50 ppm for 5 min. 5.6 Toxicity by Ingestion: Grade 3; LDx = 50 to 500 mg/kg 6.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect if temporary. 6.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to temsin, may cause smarting and reddening of the skin. 5.10 Odor Threshold: Data not available 6.11 IDLH Value: 400 ppm			9. SHIPPING INFORMATION 9.1 Grades of Purity: Commercial 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphers: No requirement 9.4 Venting: Pressure-vacuum	12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.26 Heat of Fusion: 13.79 cal/g 12.27 Limiting Value: Data Not Available 12.27 Reid Vapor Pressure: 0.4 psis
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TETRAETHYL LEAD

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	Common Synonyma TEL Lead tetraethyi Sinks in water, Poisonous, flammable vapor is produced. AVOID CONTACT WITH LIQUID AND VAPOR, Keep people zwey. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including pleves). Stop discharge if possible.			6,4	6. FIRE HAZARDS Flash Point: 200°F C.C.; 185°F O.C. Flammable Limits in Air: Data not available Fire Extinguishing Agents: Water, toam, dry chemical, or carbon dioxide Fire Extinguishing Agents Not to be Used: Not pertinent Special Hazards of Combustion	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X-Y 11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations:	
	Call fire depar Stay upwind i Isolate and re	ge it possible, infiment, and use water spray to "kricemove discharged material, earth and pollution control a		6.6 6.7	Producta: Toxic gases are generated in fires. Behavior in Fire: May explode in fires. Ignition Temperature: Decomposes above	Poison, B 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Clasatilication:	
	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Containers may explode in fire. Vapor may explode if liprited in an enclosed area. West popples, self-containers breathing apparetus, and rubber overclothing (including ployers). Combat fires from behind barner or protected location. Flood discharge area with water. Extringuish with water, do chemical, foam, or carbon dioxide. Cool exposed containers with water.			6.8 6.9	230°F Electrical Hazard: Not pertinent Burning Rate: Data not available Adiabatic Flame Temperature: Data not available (Continued)	Category Classification Health Hazard (Blue)	
	CALL FOR MEDICAL AID. VAPOR POISONOUS IF INHALED OR IF SKIN IS EXPOSED. Intaking to eyes. Move to iterate and interest in the property of the			7.2 7.3 7.4 7.5 7.6 7.7	7. CHEMICAL REACTIVITY Reactivity With Water. No reaction Reactivity with Common Materials: Rust and some metals cause decomposition. Stability During Transport Stable below 230°F. At higher temperatures, may detonate or explode when confined. Neutralizing Agents for Acids and Caustics: Not pertinent Polymerization: Not pertinent inhibitor of Polymerization: Not pertinent Molar Ratio (Reactant to Product): Data not available Reactivity Group: Data not available	12. PHYSICAL AND CHEMICAL PROPERTIES	
	Water Pollution HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife criticals. Notify operators of nearby water intakes.				12.1 Physical State at 15°C and 1 atm: Liquid Molecular Weight: 325.44 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: —215°F = —137°C = 136°K		
	1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warming-poison, water contaminant Restrict access Should be removed Chemical and physical treatment 3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Nol listed 3.2 Formula: PD[CsHs]s 3.3 IMO/UN Designation: 6.1/1649 3.4 DOT ID No. 1649 3.5 CAS Registry No.: 76-00-2		2. LABEL 2.1 Category: Poison 2.2 Class: 6	8.2 8.3	8. WATER POLLUTION Aquatic Toxicity: 0.20 mg/l/96 hr/bluegill/TL_/fresh water Waterfowl Toxicity: Data not available Blotogical Oxygen Demand (BOD): Data not available Food Chain Concentration Potential:	12.5 Critical Temperature: Not perinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.633 at 20°C (liquid) 12.8 Liquid Surface Tension: 26.5 dynes/cm = 0.0285 N/m at (est.) 25°C 12.9 Liquid Water Interfacial Tension: (est.) '40 dynes/cm = 0.04 N/m at 20°C	
			4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Dyed red or other distinctive color. 4.3 Odor: Sweet		Date not available	12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas):	
	5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Organic vapor type canister face mask for short periods; air line type for longer periods; heoprene-coated, liquid-proof gloves; protective goggles or face shield; white or light-colored clothing; trubber shoes or boots. 5.2 Symptoms Following Exposures: Increased urinary output of lead. If a large degree of absorption from inhalation or skin contact, may cause insomnia, excitability, delirium, coma and death. Do not contuse with inorpanic lead. 5.3 Treatment of Exposures: Remove victim from contaminated area and consult physician immediately. INGESTION: induce vomiting. SKIN: wash immediately with kerosene or similar petroleum distillate followed by soap and water. 5.4 Threshold Limit Value: 0.1 mg/m³ 5.5 Short Term Inhalation Limits: 0.15 mg Pb/m³ for 30 min. 5.6 Toxicity by Ingestion: Oral rat LD _{bc} = 17 mg/kg Late Toxicity: Lead poisoning 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.			9.2	9. SHIPPING INFORMATION Grades of Purity: Technical Storage Temperature: Ambient Inert Atmosphere: No requirement Venting: Pressure-vacuum	12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Deta not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available	
					6. FIRE HAZA Stoichlometric Air to Fuel Ratio: Data not a Flame Temperature; Data not available	RDS (Continued) availeble	

Common Synonyma Toluot Methylbenzene Methylbenzol Floats on water. Flammable, irritating vapor is produced.			6. FIRE HAZARDS 6.1 Flash Point 40°F C.C.; 55°F O.C. 6.2 Flammable Limits in Air: 1,27%-7% 6.3 Fire Extinguishing Agenta: Carbon dioxide or dry chemical for small fires, ordinary form for large fires.	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U
Shut off ignit Stay upwind Avoid contact Isolate and i	arge if possible. Keep people aw nition sources and cell fire depar id and use water spray to "knock act with liquid and vapor. I remove discharged material. I health and poliution control age	sriment. ck down" vzpor.	foom tor large fires. 6.4 Fire Extinguishing Agenta Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Producta: Not perlinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.	Estegory Rating
Fire	FLAMMABLE. Flashback along vapor trail Vapor may explode if ignate West googles and self-com. Extinguish with dry chemical Water may be ineffective on Cool exposed containers wit	ed in an enclosed area. ntained breathing apparatus. al, foam, or carbon dioxide. on fire.	E source of ignition and inser back. 6.7 Ignition Temperature: 997-F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Faste: 5.7 mm/min, 6.10 Adiabatic Flame Temperature: Data not available (Continued)	Fire
Exposure	difficult breathing, or lo- Move to fresh air. If breathing has stopped, gill breathing difficult, give or LIQUID Impaing to skin and eyes. If swallowed, will cause nau Remove contaminated cloth Flush affected areas with gill in IN EYES, hold evelics or	d throat, ea, vomiting, headache, dizziness, oss of consciousness. give artificial respiration. tygen. susea, vomiting or loss of consciousness. thing and shoes, plenty of water, typen and fishes with plenty of water. This CONSCIOUS, have victim const. water	7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Apents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32	Aesthetic Effect
Water Poliution	Dangerous to equatic life in Fouling to shoreline. May be dangerous if it enter Noth, local health and water Noth, operators of nearby w	ers water intakes.		PHYSICAL AND CHEMICAL PROPERTIES Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 92.14 12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K 12.4 Freezing Point:
(See Response	ONSE TO DISCHARGE se Methods Handbook) sing-high flammability	2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3	8. WATER POLLUTION 8.1 Aquatic Toxichty: 1180 mg/l/96 hr/sunfish/TL_/tresh water 8.2 Waterlowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0%. 5 days: 38% (theor), 8 days 8.4 Food Chain Concentration Potential:	12.4 Freezing Point:
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C4H:CHs 3.3 IMO/UN Designation: 3.2/1294 3.4 DOT ID No.: 1294 3.5 CAS Registry No.: 105-85-3		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Coloriess 4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant	None	29.0 dynes/cm = 0.0290 N/m at 20" 12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25" 12.10 Vapor (Gas) Specific Gravity: Not perinent 12.11 Ratio of Specific Heats of Vapor (Gas) 1.089 12.12 Laient Heat of Vaporization: 155 Btu/lb ≈ 86.1 cal/g ≈
5.2 Symptoms For headache, are aspirated, ca ingested cau 5.3 Treatment of I needed; call water for at I 5.4 Threshold Lim 5.5 Short Term in 5.6 Toxicity by ing 5.7 Late Toxicity: 5.8 Vapor (Gas) in system if pre 5.9 Liquid or Solid	otective Equipment: Air-supplied collowing Exposure: Vapors initia anesthesia, respiratory arrest. Lie causes coughing, gagging, dister causes experiency, gagging, district, Exposure: INHALATION: removil is doctor. INGESTION: do NOT It least 15 min. SKIN: wipe off, with Value: 100 ppm. holastion Limits: 600 ppm for 3 npestion: Grade 2; LDuc = 0.5; tidiney and liver damage may firmant Characteristics: Vapors resent in high concentrations. Thid Irritant Characteristics: Minitial collaboration in the content of the concentrations. Thid Irritant Characteristics: Minitial collaboration in the content of the concentrations. Thid Irritant Characteristics: Minitial collaboration in the content of the concentrations. This is the content of the concentration in the content of the concentration in the content of the	ove to tresh air, give artificial respiration and oxygen if off induce vomiting; call a doctor. EYES: flush with wash with soap and water. 30 min. 5 to 5 g/kg 1 follow ingestion. 5 cause a slight smarting of the eyes or respiratory The effect is temporary. Simum hazard. If spilled on clothing and allowed to	9. SHIPPING INFORMATION 9.1 Grades of Purity: Research, reagent, nitration-all 99.8 + %: industrial: contains \$4 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial, 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (tlame amester) or pressure-vacuum	5.61 X 10 ⁵ J/kg 12.13 Heat of Combustion: —17,430 Btu/lb —9656 Ed/g — —605.5 X 10 ⁵ J/k 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 17.17 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 1.1 psia
remain, may 5.10 Odor Threshol 5.11 IDLH Value: 2,0		of the skin.	6. FIRE HAZAR 6.11 Stoichlometric Air to Fuel Ratio: Data not av 6.12 Flame Temperature: Data not available	RDS (Continued) evailable

Common Synonyme	Watery liquid	Colorless Sweet odor	6. FIRE HAZARDS	10. HAZARD ASSESSMENT CODE	
3-Dimethylbenzene yiol	Floats on water.	Flammable, irritating vapor is produced.	6.1 Flash Point: 64°F C.C. 6.2 Flammable Limits in Air, 1.1%-6.4% 6.3 Fire Extinguishing Apents: Foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Apents Not to be	(See Hazard Assessment Handbook) A-T-U	
Call fire departm Avoid contact will Isolate and remo	i possible ricep people awa ent. th liquid and vapor, ove discharged material, th and politrion control ager	•	Used: Water may be ineflective. 5.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Pire: Vapor is heavier than air and may trevel considerable distance to a source of ignition and flash back.	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation:	
Fire F	LAMMABLE lisshback along vapor trail apor may explode if ignited lear self-contained breathin yamgush with foam, ary ch kater may be meffective or loof exposed containers with any containers	g apperatus. emical, or carbon dioxide. fire.	6.7 Ightion Temperature: 986°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.8 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stockhlometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	Category Rating Fire	
Exposure	contidousness. Alove to fresh air. I breathing has stopped, give I breathing is officult, give of LOUID Intaking to skin and eyes. I swallowed, will cause nausemove contaminated clother I such affected reas with his	the, difficult breathing, or loss of e striftcial respiration. In gen. Sea, vomiting, or loss of consciousness. In an shoes. In of water. In and flush with plenty of water. Is CONSCIOUS, have victum drink water.	7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymertzation: Not pertinent 7.6 Inhibitor of Polymertzation: Not pertinent 7.7 Most Ratio (Reaction to Product): Data not available 7.8 Reactivity Group: 32	Aestheic Effect	
Water 5	IARMFUL TO AQUATIC LIF fouling to shoreline. May be dangerous if it enten tothy local heath and wildlif city operators of nearby wi	e officials.		12. PHYSICAL AND CHEMICAL PROPERTIE 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight 106,16 12.3 Boiling Point at 1 atm: 268.4°F = 131.8°C = 405.1°K 12.4 Freezing Point	
RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3	8. WATER POLLUTION 8.1 Aquatic Toxicity: 22 ppm/95 hr/bluegill/TL _m /fresh water 8.2 Waterfowl Toxicity: Date not available 8.3 Blological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days 8.4 Food Chain Concentration Potential: Date not available		
3. CHEMICAL 3.1 CG Compatibility C	less: Aromatic Hs): in: 3.2/1907	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene; characteristic aromatic		28.6 dynes/cm = 0.0286 N/m at 20 12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas) 1.071 12.12 Latent Heat of Vaportzation: 147 Btu/fb = 61.9 cal/g =	
plastic gloves am 5.2 Symptoms Followl skin, it taken into edema. It ingeste and inver damage 5.3 Treatment of Expe oxygen if required flush with water fi 6.4 Threshold Limit V 6.5 Short Term Inhalat 6.8 Toxicity by Ingesti 6.14 Late Toxicity; Kidn 6.8 Vapor (Gas) Irritan 6.9 Toxicity (Gas) Irritan 6.9 Toxicity (Gas) Irritan 6.10 Toxicity (Gas) Irritan 6.10 Toxicity (Gas) Irritan 6.11 Toxicity (Gas) Irritan 6.12 Toxicity (Gas) Irritan 6.12 Toxicity (Gas) Irritan	re Equipment: Approved a d boots. Ing Exposure: Vapors caus bings, causes severe cougid, causes nauses, vomiting can occur. Suarre: INHALATION: removid; call a doctor. INGESTION or at least 15 min. SKIN: willies 100 ppm for 30 ont. Grade 3; LDs or \$50 te yr and liver damage. If Characteristics: Vapors (if the country of the country	500 g/kg cause a slight smarting of the eyes or respiratory	9. SHIPPING INFORMATION 9.1 Grades of Purity: Research: 99.92%; Pue: 99.9%; Technical: 99.2% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum	3.43 X 10 ⁸ J/kg 12.13 Heat of Combustion: —17,554 Btu/lb —2752.4 cal/g = —405.31 X 10 ⁸ J 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.15 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 26.01 cal/g 12.26 Limiting Value: Date not available 12.27 Reid Vapor Pressure: 0.34 psia	
.9 Liquid or Solid Irrit	e smarting and reddening o ,05 ppm	num hazard, if spilled on clothing and allowed to	HO	TES	

Diesel Oil (fuel oil #2)

Physical and chemical description: flammable, slightly viscous brown liquid obtained from the distillation of crude petroleum. Diesel oil is a mixture of hydrocarbons, predominately unbranched alkanes of 10-16 carbon atoms with smaller amounts of aromatic and polynuclear aromatic hydrocarbons (PAH's). Diesel oil floats on water, having a specific gravity of less than 1.

Uses: fuel for trucks, ships, and trains.

Toxicity: Because of their water solubility and carcinogenicity, benzene and PAH's are the chemicals of health concern in diesel oil. Benzene, found in trace amounts in diesel oil, is known to cause leukemia, a cancer of the blood forming cells. PAH's as a class (1-10% in diesel) are considered to be carcinogenic to a number of animal species. Benzo(a)pyrene is one of the most commonly found and carcinogenic PAH. The alkanes of 10-16 carbon atoms, which make up the bulk of diesel oil, are of less concern due to their very low water solubility and low toxicity.

Concentration Guidelines and Standards: The maximum tolerable concentration for diesel oil in drinking water is 100 ug/l, due to organoleptic (taste and smell) considerations. The EPA Office of Drinking Water recommends that the short term concentrations of PAH's in drinking water not exceed 25 ug/l. This is the 7 day suggested no adverse response level (SNARL) and does not take into account the long term cancer risk. These concentrations should be tolerated only in emergency situations where no other higher quality water source is available.

Naphthalene (C10H8)

Physical and Chemical Description: white crystalline solid with a characteristic "moth ball" odor. Naphthalene is more dense than water (sp. gr. 1.145) and has a solubility of 30,000 - 40,000 ug/l @ 25°C. It melts at 80°C but will sublime (volatilize from a solid) at room temperature. Naphthalene is considered a polynuclear aromatic hydrocarbon (PAH).

Uses: intermediate in dye production and formation of solvents, lubricants, and motor fuels. Used directly as a moth repellant.

Toxicity: Naphthalene may be absorbed by inhalation, ingestion or skin or eye contact. Chronic exposure can cause cataracts, kidney disease and red blood cell breakdown, especially in infants and individuals deficient in the enzyme G6PD. Naphthalene has been shown to be nonmutagenic and noncarcinogenic.

Classification: Hazardous Substance (EPA)

Hazardous Waste (EPA)

Priority Toxic Pollutant (EPA)

Persistance: Naphthalene can oxidize in the presence of light and air, 50% after 14 days in one study. Microbial degradation has also been demonstrated in the laboratory in solutions as concentrated as 3.3 ug/1. Little breakdown is expected, however, under the dark, anaerobic conditions characteristic of in-situ ground water.

Phenanthrene (C14H10)

Physical and Chemical Description: colorless, monoclinic crystals soluble in water, 1,000-1,300 ug/l @ 2.5°C, specific gravity = 1.179.

Phenanthrene is a PAH.

Uses: dyes, explosives, a natural constituent of coal tar and of diesel oil (0.35%).

Toxicity: Phenanthrene has been identified as a mild allergen and human dermal photosensitizer. Limited acute and chromic animal experiments show it to be of low to moderate toxicity.

Classification: none

Fluorene (C13H10)

Physical and Chemical Description: Combustible white solid having a density of 1.20 and a water solubility of 1980 ug/1.

Uses: Manufacture of dyestuffs.

Toxicity: Little specific information is available about the toxicity of fluorene but it is a polynuclear aromatic hydrocarbon (PAH), a group which contains known human carcinogens.

Classification: None

5.0 SITE CONTROL

- 5.1 ZONATION. Due to the nature of the work (multiple soil borings and well installations throughout the study area) and the properties of the potential chemicals found onsite, typical exclusion, contamination reduction, and support zones are not necessary or practical at all locations. Therefore, where appropriate, a "floating" exclusion zone in the perimeter of the sampling site will be established to eliminate access to the area by individuals not working on the project or involved in the assessment work. The perimeter will be at least 20 feet in radius and moved accordingly as the assessment points are moved.
- <u>5.2 COMMUNICATIONS</u>. When radio communication is not used, the following air horn signals will be employed:

HELP	three short blasts	()
EVACUATION	three long blasts	()
ALL CLEAR	alternating long and sh	ort blasts ()

- 5.3 WORK PRACTICES. General work practices to be used during ABB-ES projects are described in Chapter 9.0 of the CLEAN HASP. Work at the site will be conducted according to these established protocol and guidelines for the safety and health of all involved. Specific work practices necessary for this project or those that are of significant concern are described as follows.
- Work and sampling will be conducted in Level D clothing and equipment.

6.0 DECONTAMINATION AND DISPOSAL

- All personnel and/or equipment leaving contaminated areas of the site will be subject to decontamination, which will take place in the contamination reduction zone. General decontamination practices used during ABB-ES projects are described in Chapter 13.0 of the CLEAN HASP.
- 6.1 PERSONNEL DECONTAMINATION. All personnel leaving the study area are subject to decontamination (as necessary). The decontamination procedure required will be determined by the nature and level of contamination found at the sites. At a minimum, site personnel will remove loose soils from boots and clothing before leaving the site. More thorough decontamination procedures will be observed as dictated by site conditions. These procedures are described in Chapter 13.0 of the CLEAN HASP.
- 6.1.1 Small Equipment Decontamination Small equipment will be protected from contamination as much as possible by keeping the equipment covered when at the site and placing the equipment on plastic sheeting, not the ground. Sampling equipment used at the site will be used only once or will be field cleaned between samples with soapy water (Alconox), rinsed with clean water, rinsed with an approved Quality Assurance/Quality Control solvent, and final rinsed with organic free water.
- 6.1.2 Heavy Equipment Decontamination Drilling equipment will be protected from contamination as much as possible by placing the equipment on plastic sheeting, not the ground. The drill rig and associated drilling equipment will be cleaned with high pressure water or high pressure steam followed by a soap and water wash and rinse. Loose material will be removed by brush. The person performing this activity will be at the level of protection used during the field investigation.
- <u>6.2 COLLECTION AND DISPOSAL OF DECONTAMINATION PRODUCTS</u>. All disposable protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will be disposed of at the site. Decontamination fluids (i.e., isopropanol [e.g., split spoons and groundwater sampling pump]) will be stored in amber glass bottles. Disposable materials (e.g., gloves and TyveksTM) will be bagged and disposed of properly.

7.0 EMERGENCY AND CONTINGENCY PLAN

This section identifies emergency and contingency planning that has been undertaken for operations at this site. Most sections of the HASP provide information that would be used under emergency conditions. General emergency planning information is addressed in Chapter 14.0 of the CLEAN HASP. The following subsections present site-specific emergency and contingency planning information.

- 7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS. The site HSO or the Health and Safety designee is the primary authority for directing operations at the site under emergency conditions. All communications both on- and off-site will be directed through the HSO or designee.
- 7.2 EVACUATION. Evacuation procedures at the site will follow those procedures discussed in Chapter 14.5 of the CLEAN HASP for upwind withdrawal, site evacuation, and evacuation of the surrounding area. Evacuation from the DFSP facility will be conducted with all personnel meeting at the main facility gate at the northwest corner of the site. Evacuation will proceed by travelling south (left) on North Rhett Boulevard, away from the site.
- 7.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID. Any personnel injured on-site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

8.0 ADMINISTRATION

8.1 PERSONNEL AUTHORIZED DOWNRANGE. Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Project Manager and the HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must use the buddy system, and check in with the Site Manager and/or HSO before going downrange.

CERTIFIED ABB ENVIRONMENTAL TEAM PERSONNEL:

	+ Ken Busen	<u>+ Joe Daniels</u>
	*+ Peter Redfern	*+ Andrew Harvey
	*+ Jay Koch	*+ Kathleen O'Neil
	+ Alan Stodghill	<u>+ Peggy Layne</u>
	*+ Kevin Warner	
	 	
•		
OTHER	CERTIFIED PERSONNEL:	

- * FIRST-AID-TRAINED
- + CPR-TRAINED

8.2 HEALTH AND SAFETY PLAN (HASP) APPROVALS. By their signatures, th
undersigned certify that this HASP will be used for the protection of the healt
and safety of all persons entering this site.
Health and Safety Officer Date Date
8.3 FIELD TEAM REVIEW. I have read and reviewed the health and safet
information in the HASP. I understand the information and will comply with th
requirements of the HASP.
•
NAME:
DATE:
SITE/PROJECT:

assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet. Project: Name: Address: Home Telephone: Area Code (____) Height: _____ Weight: _____ In case of emergency, contact: Address: _____ Telephone: Area Code (___) Do you wear contact lenses? Yes () No () Allergies: List medication(s) taken regularly: _____ Particular sensitivities: Previous/current medical conditions or exposures to hazardous chemicals: Name of Personal Physician: ______ Telephone: Area Code (____)_____

8.4 MEDICAL DATA SHEET. This Medical Data Sheet will be completed by all on-site personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with

This data sheet will accompany any personnel when medical

the CLEAN HASP.

8.5 EMERGENCY TELEPHONE NUMBERS.

Police Department	(803) 747-5711
Primary Hospital (U.S. Naval Hospital	(803) 743-5130
Alternate Hospital (Baker Hospital)	(803) 744-2110
Base Fire Department	(803) 744-4073
Off-site Emergency Services	(803) 744-4073
Poison Control Center	(800) 962-1253
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(800) 414-8802
Site HSO: Alan Stodghill	(904) 656-1293
General Site Supervisor: Ken Busen	(904) 656-1293
Project Manager: Peter Redfern	(904) 656-1293
ABB Environmental HSM: <u>C.E. Sundquist</u>	(207) 775-5401 x101

8.6 ROUTES TO EMERGENCY MEDICAL FACILITIES. The primary source of medical assistance for the site is:

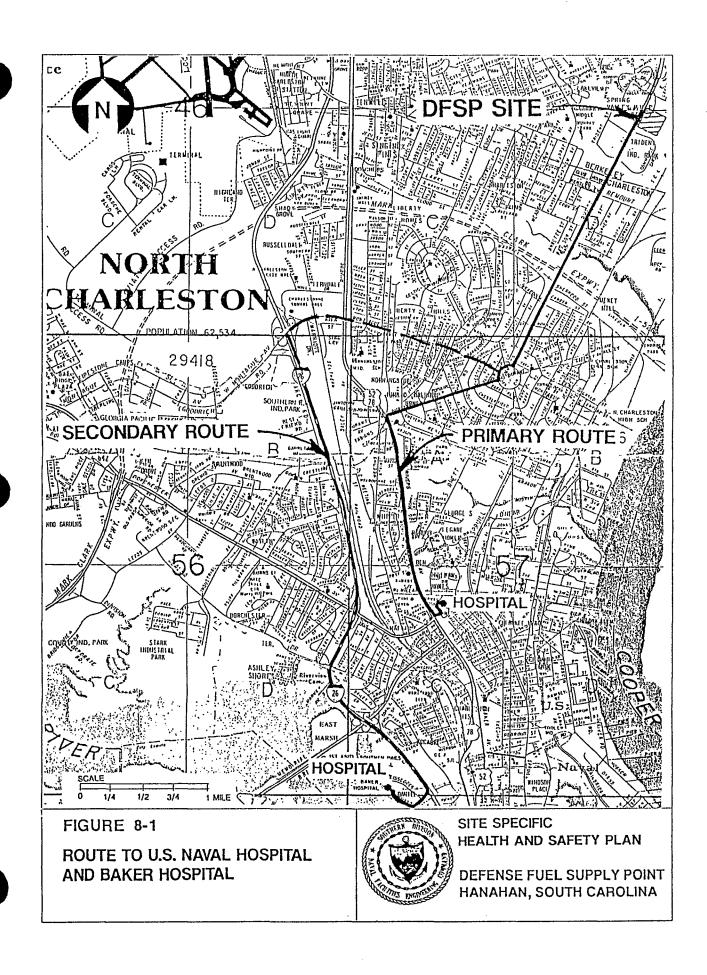
U.S. Naval Hospital Charleston, South Carolina

<u>DIRECTIONS TO PRIMARY</u>: Take Rhett Ave. (Hwy 136) south to Park Circle. Turn right and drive around Circle until you reach Montague Ave. Go west on Montague Ave. until you reach Interstate 26. Take Interstate 26 south approximately 3.5 miles. Hospital is on the right side of the Interstate. See Figure 8-1.

The alternate source of medical assistance for the site is:

Baker Hospital Charleston, South Carolina

<u>DIRECTIONS TO ALTERNATE</u>: Take Rhett Ave. (Hwy. 136) south to Park Circle. Turn right and drive around circle until you reach Durant Ave. Go west on Durant Ave. until you reach Rivers Ave. Take Rivers Ave.south approximately 1.5 miles. Hospital is on the left side of Rivers Ave. See Figure 8-1.



JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm or employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides the employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each nonserious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control emplyee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for health such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. The programs are usually administered by the State labor or Health department or a State university.

POSTING INSTRUCTIONS

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia	(404) 347-3573
Boston, Massachusetts	(617) 565-7164
Chicago, Illinois	(312) 353-2220
Dallas, Texas	(214) 767-4731
Denver, Colorado	(303) 844-3061
Kansas City, Missouri	(816) 426-5861
New York, New York	(212) 337-2325
Philadelphia, Pennsylvania	(215) 596-1201
San Francisco, California	(415) 995-5672
Settle, Washington	(206) 442-5930

Washington, D.C. 1989 (Revised) OSHA 2203

Elizabeth Dole, Secretary of Labor
U.S. Department of Labor
Occupational Safety and Health Adminstration

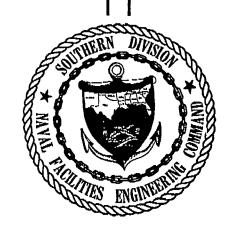
Under provisions of Title 29, Code of Federal Regualtions, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.



DRAFT REPORT

APRIL 1991 CONTAMINATION ASSESSMENT PLAN HEALTH AND SAFETY PLAN

PLUME DELINEATION
DEFENSE FUEL SUPPLY DEPOT
HANAHAN, SOUTH CAROLINA



SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND CHARLESTON, SOUTH CAROLINA 29411-0068

CONTAMINATION ASSESSMENT PLAN

PLUME DELINEATION DEFENSE FUEL SUPPLY POINT HANAHAN, SOUTH CAROLINA

CTO NO.: 00015

CONTRACT NO. N62467-89-D-0317

Prepared by:

ABB Environmental Services, Inc. 2571 Executive Center Circle East Tallahassee, FL 32301-5001

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, South Carolina 29411-0068

Ted Campbell, Engineer-In-Charge

APRIL 1991

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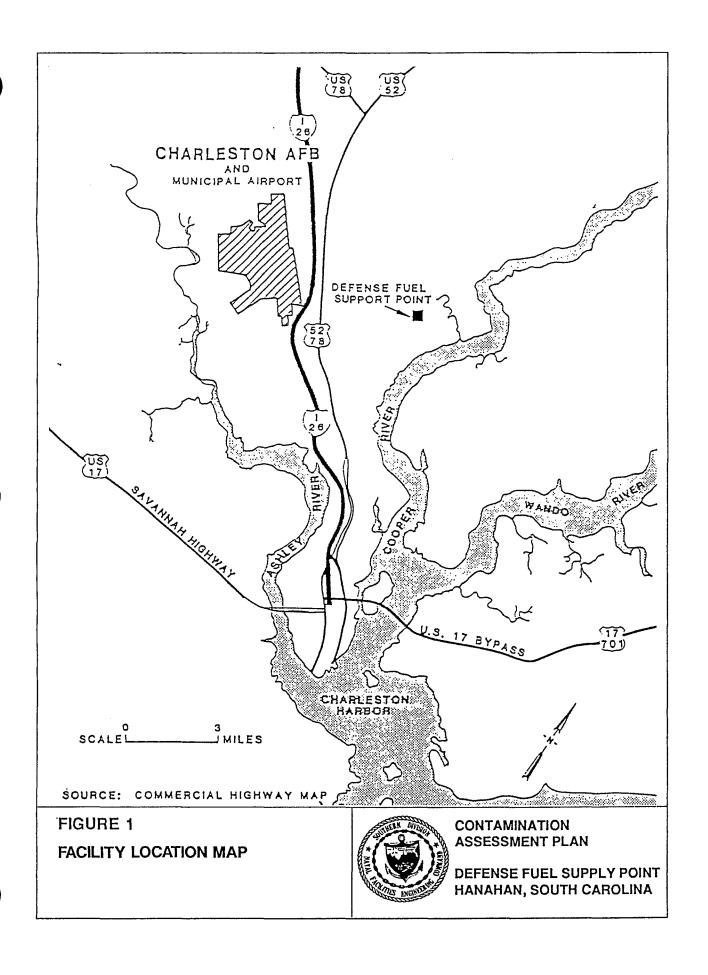
1.0 INTRODUCTION

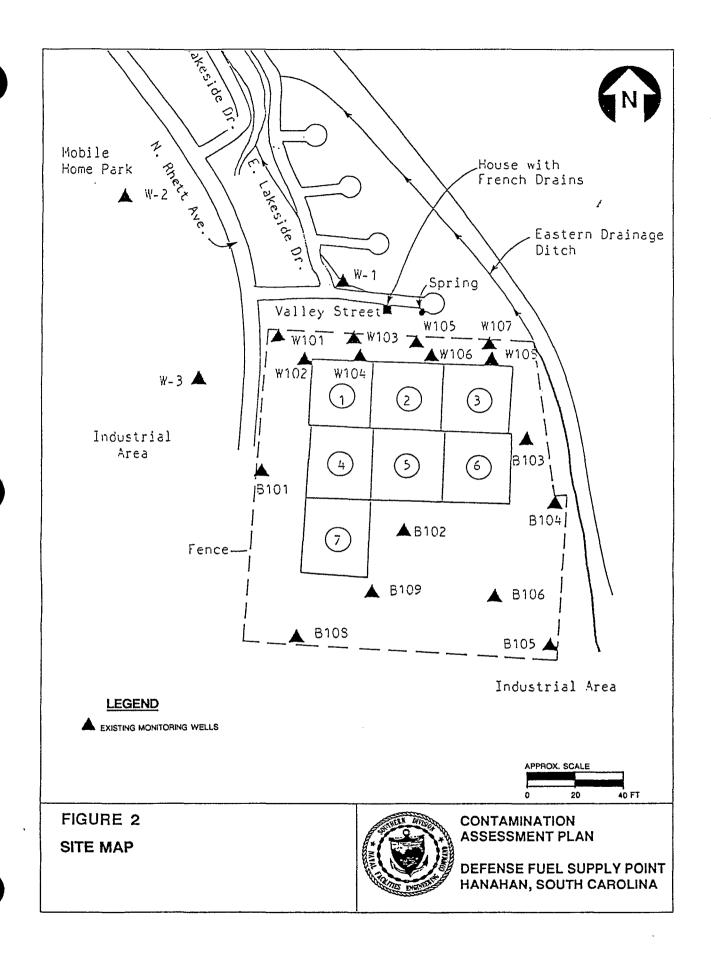
ABB Environmental Services, Inc. (ABB-ES) was contracted by the Naval Facilities Engineering Command, Southern Division (SDIV) to prepare a Contamination Assessment Plan (CAP) for the Defense Fuel Supply Point (DFSP), Hanahan, South Carolina. The purpose of the CAP is to outline a field investigation and sampling program which will assess the source and extent of petroleum contamination along the eastern and western boundaries of the site. The investigation and subsequent report will be presented by SDIV to the South Carolina Department of Health and Environmental Control (SCDHEC) for review. The following report presents the site location, summarizes previous investigations, and develops the rationale for the proposed monitoring plan to be implemented under the Contamination Assessment (CA).

2.0 BACKGROUND

2.1 SITE DESCRIPTION. The DFSP site is located approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina (see Figure 1). The site occupies approximately 48 acres just east of North Rhett Boulevard. Immediately north of the DFSP facility is a residential community called Gold Cup Springs Subdivision (see Figure 2). The areas to the west and south of the site are comprised mainly of light industry. Immediately east of the site is a U.S. Army-Navy Reservation. The facility contains seven 70,000 barrel capacity above-ground storage tanks; truck loading stands; and several buildings. Each tank is constructed of welded steel with a floating roof and is surrounded by an earthen berm. The primary product handled at the facility is JP-4 jet turbine fuel.

The DFSP facility is owned and operated by the Defense Logistics Agency, Alexandria, Virginia, and the facility property is owned by the U.S. Air Force. Environmental investigations and remedial activities at the site are being performed by SDIV.





2.2 SITE HISTORY. In September 1975, a leak developed in the bottom of storage tank No. 1 immediately after it had been cleaned and put back in service. Approximately 83,000 gallons of JP-4 jet fuel were lost before a water bottom was put in the tank. Leakage was confirmed to be the cause of the loss. The lost fuel reached the shallow, surficial aquifer and migrated northward into the Gold Cup Springs Subdivision, a subdivision of approximately 75 homes.

In November 1975, the U.S. Army Environmental Hygiene Agency (USAEHA) from Aberdeen Proving Ground, Maryland was brought in to investigate the site. Monitoring wells were installed to delineate the contamination and a well point system was constructed in December 1975 to extract the fuel from the groundwater and soils. The well point system became impractical by January 1976. A collection ditch was built along the northern border of the site to collect the remaining fuel. A second well point system was installed in March 1976 and was operated until April 1976. It was estimated that approximately 25 percent of the lost fuel was recovered by these operations.

In June 1980, the Defense Fuel Support Center (DFSC) contracted Dames and Moore to conduct a field investigation and monitoring program to assess the extent of groundwater contamination at the DFSP facility and in the Gold Cup Springs Subdivision, north of the facility. Dames and Moore installed seventeen monitoring wells and collected groundwater samples from these wells for pH, specific conductance, total organic carbon, oil and grease, and diethylene glycol monomethyl ether (a fuel system icing inhibitor) analyses. The study concluded that hydrocarbon-related contamination was present in minimal amounts and was dispersed around the site. Past fuel recovery, chemical and biological processes, and natural dilution had reduced groundwater contamination.

In 1985, additional monitoring wells installed by Science Applications International Corporation and sampled by General Engineering Laboratories revealed JP-4 related compounds, including benzene, ethyl benzene, toluene, and xylenes (BETX) in one of the off-site wells. In additional studies conducted by

McClelland Engineers, Inc., in 1986 and RMT, Inc., in 1987, JP-4 related compounds were detected in the groundwater, surface water, soil, and sediment within the Gold Cup Springs Subdivision. In addition, air monitoring studies conducted by RMT, Inc., in 1987 identified some contamination of the air in subdivision homes and throughout the neighborhood.

In October, 1987, ICF-Clements Associates, Inc. prepared a Risk Assessment for the DFSP facility. The results were that inhalation and ingestion of contamination associated with the facility, most notably benzene, could pose a potential cancer risk of greater than 1 in 1 million and that exposure to chemicals, while swimming in pools filled with contaminated groundwater, may result in significant risk. Exposure to noncarcinogens (most notably, total xylenes) may also result in a hazard index greater than 1.

As a result of the investigations at the site, bioremediation was selected as the cleanup technique. The United States Geological Survey (USGS) is currently operating and monitoring the bioremediation system at the site.

In addition to the 83,000 gallon fuel leak at tank No. 1, other areas of the facility have been found to be contaminated with petroleum hydrocarbons. Small spills and leaks are the likely contributors of contamination in these areas. The USGS performed an initial site screening of the site using a passive soil gas survey in 1990. The USGS report is currently under review by the SCDHEC and concludes that an assessment of contamination delineation should be performed along the eastern and western portions of the facility.

2.3 HYDROGEOLOGY

2.3.1 Regional Hydrogeology The Charleston, South Carolina area is underlain by four water bearing zones. These zones include the surficial water table aquifer, the Tertiary Aquifer System, the Black Creek Aquifer, and the Middendorf Aquifer.

Hanahan.CAP FGB.04.91 (CLEAN.01)

The Coastal Plain of South Carolina, that includes Charleston, consists of a series of complex interbedded unconsolidated to partially consolidated sedimentary formations of Late Cretaceous to Quaternary age. Surficial sediments within the study area consist of a variable sequence of sand, silt, and clay with a basal conglomeratic layer containing phosphate nodules that are a part of the Ladson Formation. The formation averages about 30 feet in thickness. These sediments were deposited as a result of a series of sea level encroachments and recessions which occurred during the Pleistocene epoch (Siple, 1946.)

Within the unconsolidated sediments of the Ladson Formation is contained the surficial water table aquifer. The aquifer is recharged largely by the infiltration of precipitation over the area. Locally, the aquifer may be recharged by seepage from the underlying Santee Limestone in areas where the Cooper Formation is absent. Discharge from the surficial aquifer occurs principally by evapotranspiration and through natural seepage to surface water bodies. Shallow wells account for only a small amount of discharge from this aquifer and vertical migration into underlying aquifers is limited by the Cooper Formation. Depth to the water table of the surficial aquifer ranges from 3 to 15 feet below land surface (bls) and generally reflects changes in the local topography. Well yields average approximately 85 gallons per minute (gpm) with reported transmissivities between 600 and 1,340 ft²/day (Park, 1985). The groundwater is commonly acidic and may contain high iron concentrations.

Unconformably underlying the Ladson Formation and forming the lower confining unit of the surficial aquifer and upper confining unit of the Tertiary Aquifer System is the Cooper Formation of Oligocene age. The Cooper Formation is a massive sandy, phosphatic limestone that is uniform in color and texture. The Cooper Formation requires only a few feet of thickness to effectively retard vertical groundwater flow.

Underlying the Cooper Formation and comprising the Tertiary Aquifer System are the Santee Limestone of Eocene age and the Black Mingo Formation of Paleocene

age. The Santee Limestone consists of a creamy-white to gray, slightly glauconitic lime mudstone to marl. The unit ranges from 60 to 80 feet thick in the project area (Park, 1985). Wells tapping this unit yield between 200 and 500 gpm and are mostly under artesian conditions. The Tertiary Aquifer System is recharged by infiltration in updip outcrop zones inland of the project area. Groundwater flow in the aquifer is to the southeast under relatively flat regional hydraulic gradients (Aucott and Speiran, 1985). Excessive hardness and high iron and fluoride concentrations are common in the groundwater of the Santee Limestone. Brackish water can be found at the coastal margin of Charleston County.

The Black Mingo Formation underlies the Santee Limestone and is composed of limestone, green to gray argillaceous sand, and dark-gray to black clay. This formation is approximately 400 feet thick in the project area (Park, 1985). This formation is hydraulically connected to the Santee Limestone and is the lowest unit of the Tertiary Aquifer System. The sands of the Black Mingo Formation constitute the major water-bearing strata. Well yields average approximately 230 gpm. Transmissivities in this unit range from 500 to 3,700 ft²/day and hydraulic conductivities range between 29 to 170 ft/day (Park, 1985).

Underlying the Black Mingo Formation approximately 700 feet below Mean Sea Level (MSL) are the Peedee, Black Creek, and Middendorf Formations of Late Cretaceous age. These formations consist of interbedded sand, silt, and clay with occasional limestone. Each of these formations is capable of producing groundwater under artesian pressure, however, the major water bearing zones are the Black Creek Aquifer in the Black Creek Formation and the Middendorf Aquifer in the Middendorf Formation.

The lower part of the Black Mingo Formation and the Peedee Formation contains sufficient clays and silts to form an effective vertical hydraulic barrier between the upper Tertiary Aquifer System and the lower Black Creek Aquifer. Another confining unit exists in the lower Black Creek Formation and upper

Middendorf Formation to separate the Black Creek Aquifer from the Middendorf Aquifer. Hydraulic conductivity in the Black Creek Aquifer has been estimated at 2 to 59 feet/day with a storage coefficient of 10^{-4} (Park, 1985). Groundwater flow direction in the Black Creek Aquifer is to the east. The Middendorf Aquifer is the most productive of the two aquifers with groundwater flow to the east-northeast under a gentle regional hydraulic gradient (Aucott and Speiran, 1985). Both aquifers contain potable water, however, in some areas water quality may have excessive concentrations of dissolved sodium, bicarbonate, and fluoride.

The basement rock in the region is Triassic in age and occurs approximately 3,000 feet below MSL (Park, 1985).

2.3.2 Site Hydrogeology Soil boring and monitoring well data from previous studies indicate that the DFSP site is underlain by 25 to 38 feet of recent fill and fine sands with numerous clay and silt lenses and basal layers of phosphatic gravels of the Ladson Formation. This formation thins towards the north. surficial aquifer is contained in these materials. Beneath the Ladson Formation and forming the base of the surficial aquifer is the homogeneous, dark green-gray calcareous clay and silt (marl) of the Cooper Formation. This formation is estimated to be 260 feet thick in this area and presents very competent confining layer in the site area (Dames and Moore, 1982). The contact between the Ladson and Cooper Formations is undulatory and varies between 1 and 8 feet above MSL. Depth to the surficial aquifer water table ranged from 5 to 18 feet bls during previous investigations. Some of this variability is based on surface elevations, however, the data suggests that the water table fluctuated by as much as 7 feet at the site.

The general direction of groundwater flow in the surficial aquifer at the site is to the north-northwest. Localized groundwater flow directions at the site may be controlled by topography, with groundwater flow west of the DFSP site toward the west and groundwater flow just north of the DFSP site generally towards the centerline of the north-south valley through which East Lakeside Drive runs.

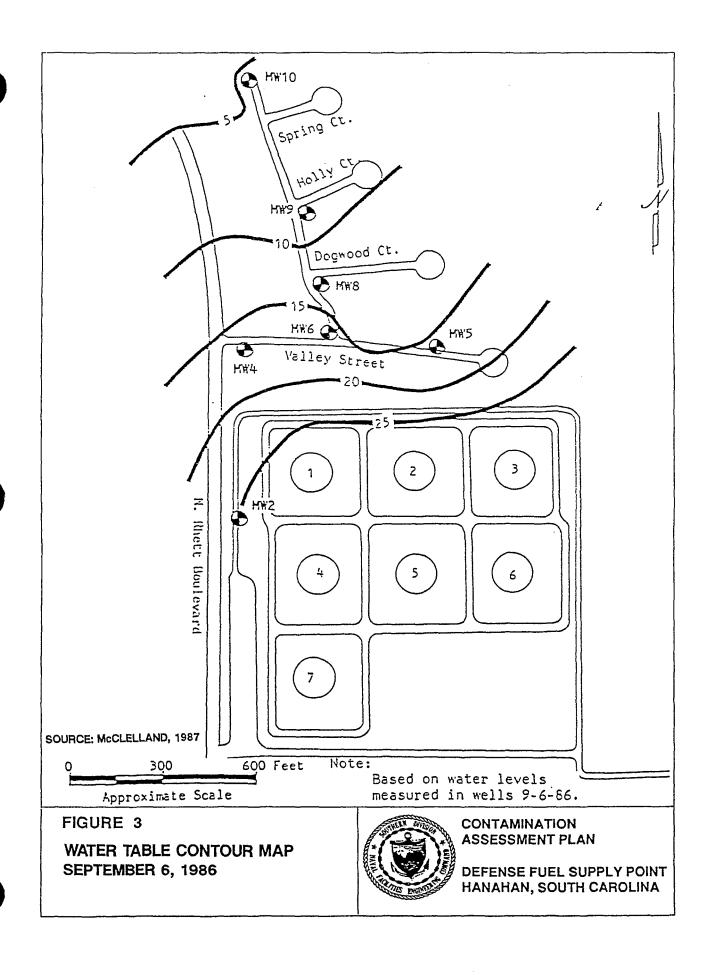
Figure 3 illustrates a water table contour map from data collected on September 6, 1986. Calculations for hydraulic conductivity from monitoring wells at the site using the Hvorslev (1951) method range from 10^{-4} to 10^{-3} cm/sec. An estimated seepage velocity at the DFSP site was calculated as 8.5×10^{-5} cm/sec or 0.24 feet/day using an average hydraulic conductivity of 8.5×10^{-4} cm/sec, an average hydraulic gradient of 0.02, and an effective porosity of 0.20 (McClelland Eng., 1987). It is believed that the discharge of groundwater by the numerous springs in the Gold Cup Springs Lake neighborhood into the ditch on E. Lakeside Drive, along with the routing of groundwater discharges by French drains installed by several residents on Valley Street, may significantly increase the rate of contaminant transport.

3.0 PROPOSED ASSESSMENT PLAN

It is proposed that a two phase field investigation be undertaken to assess the suspected contaminant plumes along the eastern and western sides of the DFSP site. The phased approach is discussed in the following two sections. During both the Phase I and Phase II field investigations the ABB-ES field leader will meet on-site or at SDIV with the SDIV Engineer-In-Charge (EIC) on a weekly basis to discuss the field investigation progress and findings.

3.1 PHASE I FIELD INVESTIGATION. The purpose of the Phase I investigations is to assess the approximate horizontal extent of the contaminant plumes at the eastern and western sides of the site by obtaining groundwater samples from temporary wellpoints and soil samples from hand augered soil borings and screening these samples with a field gas chromatograph (groundwater) and Organic Vapor Analyzer (soil). The information obtained during this field screening phase will assess the extent of the contaminant plumes and direct the placement of monitoring wells during the Phase II investigation.

During the Phase I investigation, any necessary permits, off-site utility clearances, and right-of-way easements and private property access approvals will

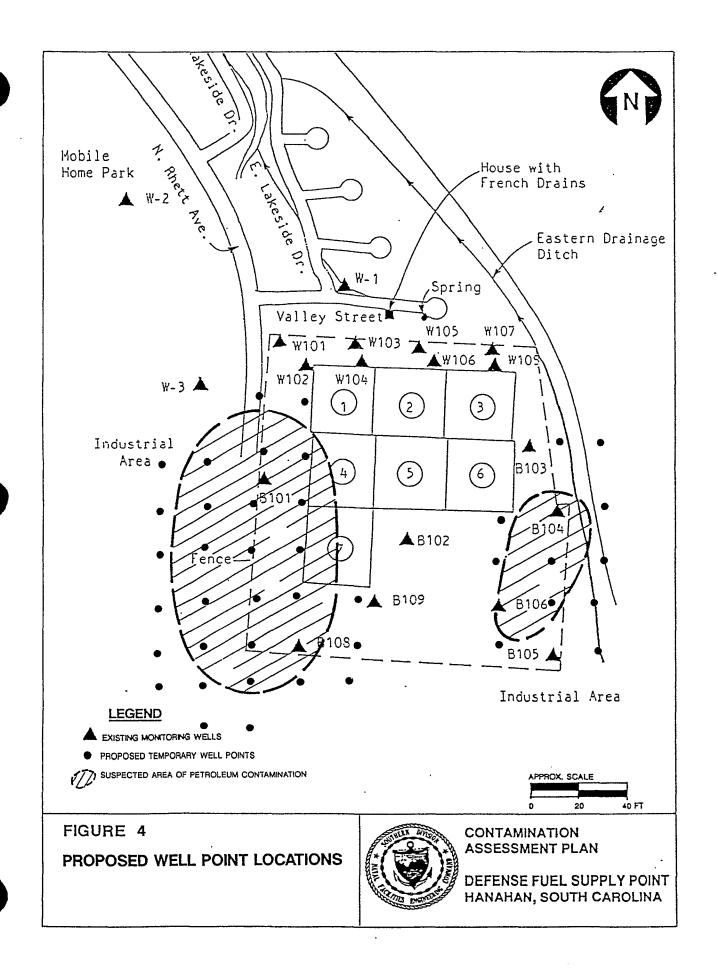


be obtained with the help of Navy personnel or their representatives. In addition, information on the location of potable water wells within 1/4 mile radius of the site will be obtained from SDIV, DFSP, SCDHEC, and previous investigation reports.

The Phase I field investigation will consist of installing up to 40 temporary wellpoints along the western side of the DFSP site to assess the western contaminant plume. Up to 16 temporary wellpoints will be installed to assess the eastern contaminant plume. The locations of the proposed temporary wellpoints are shown on Figure 4. The wellpoints will be installed using a KV Macho System or equivalent.

Groundwater samples will be collected at each wellpoint location and screened for the presence of the petroleum contamination constituents benzene, ethylbenzene, toluene, and xylenes (BETX) using a field gas chromatograph (GC). In addition, up to 20 shallow soil borings will be conducted using a hand auger where possible at both the eastern and western contaminated areas to assess soil contamination and local lithology. Soils will be classified in accordance with the Unified Soil Classification System. Soil samples will be collected from each soil boring and placed in 16 ounce glass jars. The soil samples will be screened for petroleum contamination by head space analysis using an Organic Vapor Analyzer (OVA) equipped with a Photoionization Detector (PID).

3.2 PHASE II FIELD INVESTIGATION. The purpose of the Phase II field investigation is to further assess the horizontal extent of the petroleum contamination in the eastern and western areas of the DFSP facility, assess the vertical extent of the petroleum contamination, and characterize the contamination. This will be accomplished through the drilling of soil borings in areas where hand augering could not take place to collect soil samples for OVA screening; the installation of permanent groundwater monitoring wells; the collection of groundwater samples from the monitoring wells for laboratory analysis of jet fuel constituents; surveying of the elevations of the monitoring wells to determine aquifer flow



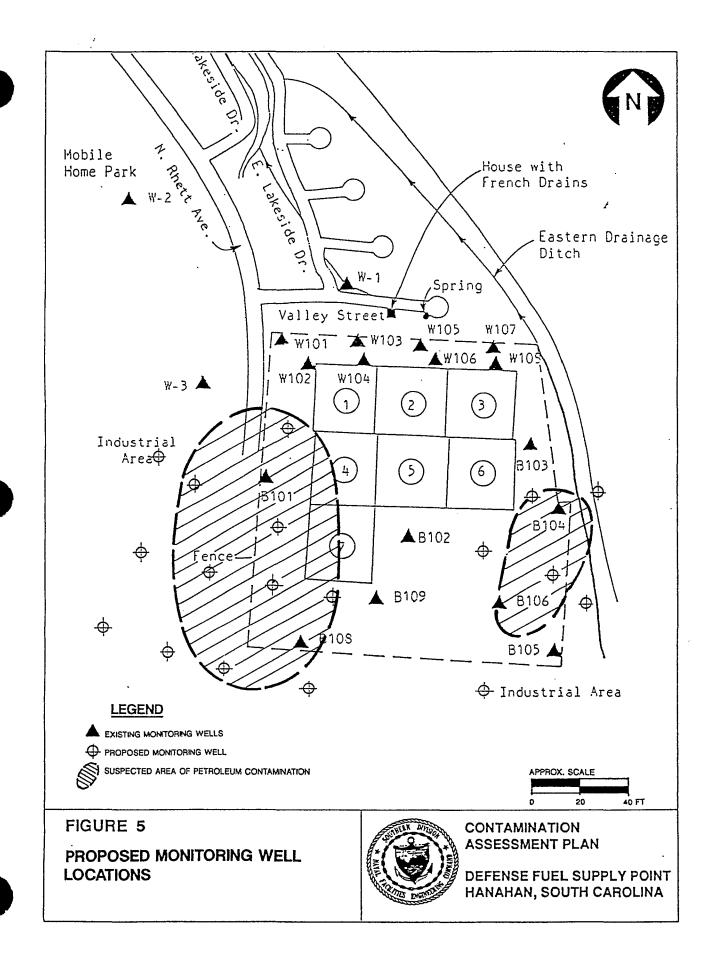
direction and gradient; and aquifer testing on select monitoring wells to estimate aquifer characteristics.

During the Phase II field investigation 18 shallow monitoring wells (up to 15 feet in depth) will be installed at the site to assess the eastern and western contaminant plumes. The location of the proposed monitoring wells is shown on Figure 5; however, exact well placement will depend on the results of the Phase I investigation. All monitoring wells will be constructed of 2-inch inside diameter (ID), flush threaded Schedule 40 polyvinyl chloride (PVC) screen and riser. The well screen will be comprised of a 10 foot section of 0.010 inch slotted screen. Well screens will be set such that a minimum of 2 feet of screen will be above the water table. Depth to the water table in existing wells will be measured to determine the depth interval for the well screen. The remainder of the well casing will consist of solid riser pipe to the ground surface. Total well length and depth for the shallow monitoring wells is not expected to exceed 15 feet bls.

The well annulus will be filter packed with No. 6-20 sand or an acceptable grade of sand to at least 1 foot above the well screen. A 2-foot bentonite seal will be placed above the sand pack with the remaining annular space grouted to the surface. Wells will be flush mounted with the ground surface and will consist of a locking protective cap and a steel subsurface vault set in the pavement around each well riser pipe. Typical construction details for the proposed monitoring wells are provided in Figure 6.

In addition to the monitoring wells, up to 15 shallow soil borings will be advanced with a drill rig in those areas where it was not possible to perform the Phase I manual soil borings.

Upon completion of the monitoring well installation, the wells will be developed using a centrifugal pump until the groundwater is sediment free or as clear as the aquifer will allow in a reasonable amount of time. The measuring point for



--- PROTECTIVE STEEL CASING -LOCKING WELL CAP -CEMENT SEAL BENTONITE SEAL - 2" DIA, SCH. 40 PVC WELL -0.010" SLOTTED SCREEN -6/20 SAND PACK FIGURE 6 CONTAMINATION ASSESSMENT PLAN TYPICAL MONITORING WELL **INSTALLATION DETAIL** DEFENSE FUEL SUPPLY DEPOT HANAHAN, SOUTH CAROLINA

groundwater elevation on the PVC riser pipe and the land surface adjacent to each monitoring well will be surveyed to within \pm 0.01 feet based on an arbitrary reference elevation of 50 feet.

Groundwater samples will be collected from the newly installed monitoring wells in addition to the eleven existing wells at the site and analyzed for jet fuel constituents (USEPA Methods 602, 610, 239.2, and 418.1). At the western contamination area 16 groundwater samples will be collected and at the eastern area, 13 groundwater samples will be collected. In addition, 3 duplicate samples; 2 equipment blanks; 1 field blank; and 5 trip blanks will be obtained.

Groundwater samples will be shipped via overnight carrier to an approved analytical laboratory. Sampling and the subsequent analytical program will comply with ABB-ES's Comprehensive Quality Assurance Plan (ComQAP).

During the Phase I and II field investigations, ABB-ES personnel and their subcontractors will coordinate efforts with site personnel to dispose of contaminated fluids and soils. ABB-ES and their subcontractors will supply Department of Transportation (DOT) 17-C open top 55-gallon drums and will dispose of contaminated soils, water, and miscellaneous materials (gloves, booties, etc.) into these drums and stage them on site. It will be the Navy's responsibility to dispose of any hazardous waste.

3.3 PREPARATION OF REPORTS. Upon completion of the field investigations and receipt of the analytical laboratory results of the groundwater samples, draft, 100 percent complete, and final Contamination Assessment Reports (CARs) will be prepared and submitted to SDIV for review and approval. The reports will discuss site background information, site conditions, findings, and recommendations for the eastern and western areas of the DFSP site. Recommendations shall be made as to the need for any follow-up reports. Site location maps, locations of soil borings, wellpoints, and monitoring wells, groundwater contour maps, and contamination delineation maps will be included with the reports.

Based on the findings, conclusions, and recommendations of the final CAR, draft, 90 percent complete, 100 percent complete, and final follow-up reports will be prepared for the two areas of concern. The reports shall be either No Further Action Proposals (NOFAP), Monitoring Only Proposals (MOP), or Preliminary Remedial Action Plans (PRAP).

If a PRAP is developed for the DFSP site it will include the following items:

- summary sheet of the Contamination Assessment Report,
- general discussion of the technical and economic feasibility of the selected remedial system and why it was chosen over other remedial options,
- · general discussion of the rationale of the selected system,
- comparison of contaminant levels found with existing state and EPA cleanup criteria in table format.
- disposition and expected contamination concentrations in any effluent from the proposed cleanup method,
- costs estimates and schedules for the design phase, construction/startup phase and the operation phase,
- designation of monitoring wells and proposed methodology for verifying accomplishment of PRAP goals (cleanup levels),
- general discussion of the treatment of contaminated soils, and
- recommendations for conducting pilot studies and obtaining addition information.

The PRAPs will compare from two to four remedial technologies for cleanup of both groundwater and soil and the selected technology will be justified based on technical and economic feasibility. A conceptual design and rationale for the design will be provided for the selected remedial technology.

It is our understanding that Southern Division will develop performance specifications for construction that are based on the PRAP and the CAR. While these documents will provide some of the information necessary to develop performance specifications, neither document will be biddable. Additional site information that may be needed to develop the performance specifications but not included in this scope is as follows:

- horizontal and vertical survey data,
- · locations of existing utilities, and
- · location and available amount of electric power.

4.0 SCHEDULE

A projected schedule to complete the Contamination Assessment field investigation is approximately 7 weeks. The field investigation is tentatively scheduled to begin the week of August 12, 1991. Upon completion of the field investigation, approximately 3 weeks will be required before receipt of the laboratory analyses of the groundwater samples that were collected during the investigation. A draft Contamination Assessment Report will be prepared and submitted to SDIV by October 29, 1991. If proper time schedules for report review are followed, a draft follow-up report has been scheduled to be delivered to SDIV by December 18, 1991.

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SITE-SPECIFIC HEALTH AND SAFETY PLAN FOR CONTAMINATION ASSESSMENT INVESTIGATION

DEFENSE FUEL SUPPLY POINT HANAHAN, SOUTH CAROLINA

CTO NO.: 00010

Contract Number N62467-89-D-0317

Prepared by:

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Prepared for:

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Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
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APRIL 1991

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REFERENCES

The following chapters of the Comprehensive Long-term Environmental Action Navy (CLEAN) Program District I Generic HASP are applicable for the work anticipated at the site: $^{\prime}$

<u>/</u> 2.0	AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL
<u>✓</u> 3.0	TRAINING PROGRAM
<u>/</u> 4.0	MEDICAL SURVEILLANCE PROGRAM
<u>✓</u> 5.0	ENGINEERING CONTROLS
<u>✓</u> 6.0	PERSONAL PROTECTIVE LEVEL DETERMINATION
<u>√</u> 7.0	MONITORING EQUIPMENT
8.0	ZONATION
<u>√</u> 9.0	WORK PRACTICES
10.0	CONFINED SPACE ENTRY PROCEDURES
11.0	EXCAVATION AND TRENCHING
<u>✓</u> 12.0	TEMPERATURE EXTREMES HEAT STRESS COLD STRESS
<u>✓</u> 13.0	DECONTAMINATION
<u>✓</u> 14.0	EMERGENCY PLANNING
<u>✓</u> 15.0	HEALTH AND SAFETY FORMS AND DATA SHEETS HEALTH AND SAFETY AUDIT FORM ACCIDENT REPORT FORM HEALTH AND SAFETY OFFICER (HSO) CHECKLIST FOR FIELD OPERATIONS MATERIAL SAFETY DATA SHEETS LIQUI-NOX ETHYL ALCOHOL (denatured) TRISODIUM PHOSPHATE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) POSTER

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8-1	Routes to U.S. Naval Hospital and Baker Hospital	
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1.0 GENERAL

1.1 SCOPE AND PURPOSE. This Health and Safety Plan (HASP) has been prepared in conformance with the Navy CLEAN Program District I (CLEAN) HASP and is intended to meet the requirements of 29 Code of Federal Regulations (CFR) 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all ABB-ES personnel, contractor personnel, or third parties entering the site.

1.2 PROJECT PERSONNEL.

- 1.2.1 Project Manager The project manager (PM) is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP, the necessary resources to meet requirements of this HASP, the coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements, and the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project.
- 1.2.2 General Site Supervisor The General Site Supervisor is either the PM or the PM's designee who is on-site and vested with the authority by the PM to carry out day-to-day site operations, including interfacing with the site Health and Safety Officer (HSO).
- 1.2.3 Health and Safety Officer The HSO for this project has been designated by the PM with concurrence of the Health and Safety Supervisor (HSS) or Health and Safety Manager (HSM). The HSO will have at least an indirect line of reporting to the HSM through the HSS for the duration of his/her assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the CLEAN HASP. The HSO will investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting an ABB-ES site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.
- 1.3 TRAINING. Training is defined under the CLEAN HASP, and all personnel entering potentially contaminated areas of this site must meet the requirements of 29 CFR 1910.120. Personnel without the required training will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 3.0 of the CLEAN HASP for further information.

1.4 MEDICAL SURVEILLANCE. All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the CLEAN HASP. Personnel who have not received medical clearance will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 4.0 of the CLEAN HASP for further information.

2.0 SITE CHARACTERIZATION AND ANALYSIS

- 2.1 SITE NAME, LOCATION, AND SIZE. The Defense Fuel Supply Point (DFSP) site is located just east North Rhett Boulevard approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina. The facility occupies approximately 48 acres.
- 2.2 SITE HISTORY AND LAYOUT. In September 1975, a leak developed in the bottom of one of seven 70,000 barrel capacity aboveground storage tanks. Approximately 83,000 gallons of JP-4 jet fuel was lost. The initial recovery operation recovered approximately 25 percent of the lost fuel. This leak occurred along the northern boundary of the property. Subsequent investigations from 1979 to 1990 indicated that petroleum contaminant plumes may exist along the eastern and western boundaries of the facility as a result of past spills and leaks.
- 2.3 SCOPE OF WORK (WORK PLAN). ABB-ES will conduct a contamination assessment along the eastern and western boundaries of the facility. The assessment will include shallow soil borings, collection of groundwater samples from temporary wellpoints, and the installation and sampling of permanent monitoring wells. The work will be conducted in Level D protective wear.

3.0 TASK ANALYSIS

3.1 TASK ONE.

- <u>3.1.1 Hazardous Substances</u> The contaminants of concern known or suspected to be present on-site, along with any established exposure limits for those substances are listed in Table 3-1.
- 3.1.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered at the site.
- 3.1.2.1 Health Hazards Contaminants to which personnel may be exposed are gasoline, diesel fuel, waste oil and their constituents. The primary hazard at the site is from fire/explosion. There should be no smoking allowed in the vicinity of the site. There must be adequate ventilation, especially when sampling in an enclosed or semi-enclosed (i.e., a pit) space. There should always be a fire extinguisher within easy access. The waste oil will contain primarily fuel oil contaminated with water or other substances. The primary component of the waste oil will be polynuclear aromatic hydrocarbons. See Table 1 for a summary of the above contaminants.

Polynuclear aromatic hydrocarbons (PAHs) for the purposes of this plan and study include those listed as parameters for EPA Method 610. Some of the more notable PAHs from this method include acenaphthene, anthracene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene.

- All activities at this site are in unconfined areas and will not allow on-site personnel to encounter either high vapor concentrations or strong liquid concentrations of any of the substances described above; therefore, potential health risks are minimal.
- 3.1.2.2 Safety Hazards Safety hazards include those hazards which personnel may be exposed to that are unrelated to hazardous wastes. These include hazards such as heat stress, operation and presence around heavy equipment, lifting of objects, vehicle traffic, and snake bites. Extreme caution should be exhibited by all personnel while conducting work around drill rigs, backhoes, and other heavy equipment. During hot days, personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress.

Lifting of heavy objects should be done with caution. Personnel should assist one another with moving heavy objects or use the appropriate equipment to accomplish these tasks. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes.

Power substations, powerlines, underground utilities, and underground pipelines are to be avoided during drilling operations. Necessary work permits for activities at the Naval activities will be obtained from the Public Works Department or the appropriate department (e.g., fire department, etc.).

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Table 3-1 Contaminants of Concern

Health and Safety Plan Defense Fuel Supply Point Hanahan, South Carolina

Chemical -	Approximate odor Thresh- old (ppm)	Permissible Exposure Limits (ppm)	Threshold Limit Value (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Benzene	4.68	1	10	Colorless liquid, pleasant aromatic odor.	Moderate skin irritant.	Inhalation of large amounts attacks central nervous system (CNS); chronic poisoning causes leukemia.
Ethyl benzene	140	100	10	Colorless liquid, aromatic odor.	Moderate skin irritant.	Liquid blisters skin, inhalation results in dizziness, depression.
Toluene	0.17	100	100	Colorless liquid, pleas- ant aromatic odor.	Mild skin irritant.	Ingestion or aspiration can cause pulmonary edema, depressed respiration.
Xylene	0.05	100	200	Colorless liquid, aromatic odor.	Moderate skin irritant.	Inhalation causes headache and dizziness; vapors irritate eyes; can be fatal if ingested.
Naphthalene		10	10	Colorless to brown solid with an odor of mothballs	Moderate skin irritant	Inhalation causes headache and confusion; vapors irritate eyes.
Lead				Soft, ductile, gray, metal, soluble in water containing a weak acid.		Lead poisoning may cause fatigue, anemia, abdominal pains, and neurological dam- age.

Notes:

ppm = parts per million.

- 3.1.2.3 Conclusions and Risk Assessment Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be <u>low</u>, assuming appropriate health and safety practices are maintained.
- 3.1.3 Protective Measures The following are the protective measures that will be used at the site.
- 3.1.3.1 Engineering Controls Whenever needed, engineering controls (i.e., fans to blow volatilized chemicals away form the work area) will be used.
- 3.1.3.2 Levels of Protection A level D work uniform will be used at the site. Level D Protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

- 3.1.4 Monitoring It is intended that real time monitoring instrumentation will be used to monitor the work environment in order to ensure the appropriate level of protection for the site team.
- 3.1.4.1 Air Sampling To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

1. Photovac Organic Vapor Analyzer 10S50 (OVA)

If the OVA detects a steady measurable quantity of organic vapors greater than 5 ppm (above background conditions) in the breathing zone, the field team will withdraw from the site until health and safety conditions at the site are reevaluated.

3.1.4.2 Personal Monitoring Personal monitoring will be undertaken to characterize the personal exposure of high risk employees to the hazardous substances they may encounter on-site. Personal monitoring will be conducted on a representative basis. Personnel who are represented by the sampling will be noted in field logs.

The following personal monitoring equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the maintenance and calibration of the equipment.

1. Thermoluminescent Dosimetry Body Badge

4.0 DATA SHEETS

Hanahan.HSP FGB.04.91 (CLEAN.01)

Common Synor Boizol Eenzole	Non Synonyms Watery liquid Colorless Gasoline-like odor 6.1 Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F. 6.4		Flammable Limits in Air: 1.3%-7.9% Fire Extingulahing Agents: Dry chemical, floam, or carbon dioxide		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U-V-W		
Wear pooglet Shut off ignit Stop discharg Stay upwind Isolate and re	s and self-co ion sources a ge if possible and use wate emove dischi	and vapor. Keep per intained breathing a and call fire departs: er spray to "knock arged material, sliution control ager	pparatus, nent. down'' vapor.	6.5 6.6	Used: Water may be ineffective Special Hazards of Combustion Products: Not pertinent Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back		11. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Water Transportation: Category Rating
Fire	FLAMMABLE. Flashback slong vapor trail may occut. Vapor may explode if ignised in an enclosed area. Wear goggles and self-contained breatting apparatus. Extinguish with for chemical, floating or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.			1 1	Ignition Temperature: 1097/F Electrical Hazard: Class I, Group D Burning Rate: 6,0 mm/min, Adiabatic Flame Temperature: Data not available Stoichlometric Air to Fuel Ratio: Data not available Flame Temperature: Data not available		Fire 4
Exposure	VAPOR Irritating It Inhaled. Move to fir It preathing It breathing It LIQUID Irritating It Harmful It Remove on Flush affect	esh air g has stopped, give g is difficult level of skin and eyes. I swallowed, ontaminated cichinded areas with personal eyelios ope OWED and worm?	ne, difficult breathing, or loss of consciousness, artificial respiration year.	7.2 7.3 7.4 7.5 7.6	7. CHEMICAL REACTIVITY Reactivity With Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not perinent Polymertzation: Not perinent Inhibitor of Polymertzation: Not perinent Molar Ratio (Reactant to Product): Date not available Reactivity Group: 32	11.3	Reactivity Cither Chemicals 2 Water 1 Self Reaction 0 NFPA Hazard Classification: Category Classification Health Hazard (Biue) 2 Fiammability (Red) 3 Reactivity (Yellow) 0
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearcy water intakes.					12.1 12.2 12.3	PHYSICAL AND CHEMICAL PROPERTIES Physical State at 15°C and 1 atm: Liquid Molecular Weight: 78.11 Bolling Point at 1 atm: 176°F = 80.1°C = 353.3°K Freezing Point
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Resmot access 2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3		8.2	8. WATER POLLUTION Aquatic Toxicity: 5 ppm/6 hr/minnow/lethal/distilled water 20 ppm/24 hr/sunfish/TL _m /iap water Waterfowl Toxicity: Data not available Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days	12.5 12.6	42.0°F = 5.5°C = 276.7°K Critical Temperature; 552.0°F = 286.9°C = 562.1°K Critical Pressure; 710 psis = 48.3 atm ≈ '2.88 MN/m² Specific Gravity; 0.878 at 20°C (liquid)		
3.1 CG Compatibility Hydrocarbon 3.2 Formula: C ₆ H ₆ 3.3 IMO/UN Design 3.4 DOT ID No.: 11	AO/UN Designation: 3.2/1114 odor; characteristic odor			Food Chain Concentration Potential: None	12.11	35.0 dynes/cm = 0.035 N/m at 20°C Vapor (Gas) Specific Gravity: 2.7 Ratio of Specific Heats of Vapor (Gas): 1.061 Latent Heat of Vaporization: 169 Blu/lb = 94.1 cal/g = 3,94 x 10 ³ J/kg Heat of Combustion: —17.460 Blu/lb	
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neopiene. 5.2 Symptoma Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headdiche, breathlessness, chest constriction. Come and possible death. 5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water, remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, stan resuscristion, administer oxygen. 5.4 Threshold Limit Value: 10 ppm 5.5 Short Term Inhaistion Limita: 75 ppm for 30 min. 6.6 Toxicity by Ingestion: Grade 3; LDse = 50 to 500 mg/kg 6.7 Late Toxicity: Leukemia 8.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary. 6.9 Liquid or Solid Irritant Characteristics: Minimum hazard, If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.		es. 9.2 or 9.3 9.4	9. SHIPPING INFORMATION Grades of Purity: Industrial Dure	12.15 12.16 12.25 12.26	= -9696 cat/g =406 0 X 10° J/kg Heat of Decomposition: Not periment Heat of Solution: Not periment Heat of Polymerization: Not periment Heat of Pusion: 30.45 cat/g Limiting Value: Date not available Reid Vapor Pressure: 3.22 psia		
5.10 Odor Thresho 5.11 IDLH Value: 2.	id: 4.68 ppm				···		

ETHYLBENZENE

l								····
Common Synor Phenylethane EB		iquid Floats on water. F	Coloriess lammable, irmsting vapo	Sweet, gasoline-like odor of is produced.	6.1 6.2 6.3	effective), water fog, carbon dioxide or		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U
Wear goog (ind Shut off ign Stop discha Stay upwind isclate and	es self-containe cluding gloves) fron sources and tige if possible t and use water temove dischard	nd call fire depart	ralus, and tubbet overcl ment down" vapot.	lotting		Used: Not perment Special Hazards of Combustion Products: Irritating vapors are generated when heated. Behavior in Fire: Vapor is heavier than air		11. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Water Transportation: Paties
Fire	Vapor may e inc Emingush w Water may 1	n lieti ropav pool explode it ignited	in an enclosed area. form, or cerbon dicride fire	nd rubber everclothing e.	6.7 6.8 6.9 6.10	and may travel considerable distance to the source of ignition and flash back. Ignition Temperature: 860°F Electrical Hazard: Not pertinent Burning Rate: 5.8 mm/min. Adiabatic Flame Temperature: Data Not Available		Category Rating Fire 3 Health 2 Liquid or Solid Irritant 2 Poisons 2 Water Polution 1 Aquatic Toxicity 1 Aquatic Toxicity 3
Exposure	VAPOR Imating to eit inhalised, we it breathing it breathing it breathing it breathing it breathing it built burn skill Harmful if swift affects affects affects if swift.	has stopped give of its ordizating veloci in and eyes, wallowed, wallowed,	s or difficult breathing, a particular respiration angen ng and shoes. If y of mater is and plenty is CCNSCIOUS have viet.	of water	7.2 7.3 7.4 7.5 7.6 7.7	7. CHEMICAL REACTIVITY Reactivity With Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustica: Not pertinent Polymerization: Not pertinent Inhibitor of Polymerization: Not pertinent Motar Ratio (Reactant to Product): Date Not Available Reactivity Group: 32	11.3	Aesthetic Effect
Water Pollution	Fouling to shi May be dang Notify local		E 0":016'S	ENTRATIONS.			12.1 12.2 12.3	PHYSICAL AND CHEMICAL PROPERTIES Physical State at 15°C and 1 atm: Liquid Molecular Weight 106.17 Boiling Point at 1 atm: 277.2°F = 136.2°C = 408.4°K Freezing Point
(See Response Mechanical i Should be re		idbook)	2. LABEL 2.1 Category: Flan 2.2 Class: 3	nmable liquid	8.2 8.3	8. WATER POLLUTION Aquatic Toxicity: 29 ppm/96 hr/bluegill/TL _m /fresh water Waterfowt Toxicity: Data not available Biological Oxygen Demand (BOD): 2.8% (theor.), 5 days Food Chain Concentration Potential: None	12.5 12.6 12.7	
3.1 CG Compatibility hydrocarbon 3.2 Formula: C+H2C 3.3 IMO/UN Dealog 3.4 DOT ID Hoz 11 3.5 CAS Registry h	CH ₂ CH ₂ sation: 3.3/1175 75	etic					12,10 12,11	Liquid Water Interfacial Tension: 35.45 cynes/cm = 0.03548 N/m at 20°C Vapor (Gas) Specific Gravity: Not periment Ratio of Specific Heats of Vapor (Gas); 1.071 Latent Heat of Vaporization: 144 Blu/lb = 80.1 cal/g = 3.55 × 3.01 // lbc
5.2 Symptoms Fol- Moderate inti- 5.3 Treatment of I warm and ou INGESTION: chemical pne and get medi- 5.4 Threshold Lim 5.5 Toxicity by Ing 5.7 Late Toxicity: I 5.8 Vapor (Gas) Inr find high con- 5.9 Liquid or Solid	ilowing Exposulation of eye with Exposure: INNA siet, and get med induce vomiting pumonitis. SKIN. ical attention; re it Value: 100 pp. halation Limitaz persion: Grade 2 Data not availab ritant Character centrations unpil	ent: Self-contained with comeal injury; a LATION; it is a LATION; it is did in the prompt g only upon physical prompt g only upon physical prompt and washing it is a companion of the contained with the contained with the contained with the contained contained contained with the contained with	possible, Irritates akin an ects occur, remove victif by; if breathing stops, si- cian's approval; material appty flush with plenty of contaminated clothing b min, 5 g/kg (rat) ause moderate irritation ct is temporary, s smarting of the skin a:	ie, dzziness, depression, nd may cause blisters, m to fresh air, keep him we arrificial respiration, if in lung may cause if water (15 min, for eyes)	9.2 9.3	9. SHIPPING INFORMATION Grades of Purity: Research grade: 99.96%; pure grade: 99.5%; technical grade: 99.0% Storage Temperature: Ambient Inert Atmosphera: No requirement Venting: Open (flame arrester) or pressure-vacuum	12.14 12.15 12.16 12.25 12.26	3.35 X 10° J/kg Nest of Combustion: —17.780 Btu/lb = —9877 cal/g = —413.5 X 10° J/kg Heat of Decomposition: Not pertinent Heat of Solution: Not pertinent Heat of Folymerization: Not pertinent Heat of Fusion: Data Not Available Limiting Value: Data Not Available Reid Vapor Pressure: 0.4 paia
short exposur 5.10 Odor Threshol 5.11 IDLH Value: 2,0	d: 140 ppm	secondary burns o	on long exposure.			6. FIRE HAZAF Stoichlometric Air to Fuel Ratio: Data Not A Flame Temperature: Data Not Available	-	stinued)

ETHYLENE DIBROMIDE

Coloriess Sweet odor Liquid Common Synonyms 6. FIRE HAZARDS 10. HAZARD ASSESSMENT CODE 1, 2-Dibromoethane Ethylene bromide Bromofume sym-Dibromoethane Dow-fume 40, W-10, W-15, W-40 Flash Point: Not flammable (See Hazard Assessment Handbook) Flammable Limits in Air. Not flammable Sinks in water. Poisonous vapor is produced. Freezing point is 50°F. Fire Extinguishing Agents: Not pertinent Fire Extinguishing Agents Not to be Used: Not pertinent Stop discharge if possible. Keep people away. Avoid contact with liquid and vapor, Isolate and remove discharged material. Notify local health and pollution control agencies. Special Hazards of Combustion 11. HAZARD CLASSIFICATIONS Products: Decomposition gases are toxic 11.1 Code of Federal Regulations: and irritating. ORM-A Behavior in Fire: Decomposes into toxic 11.2 NAS Hazard Rating for Bulk Water irritating gases. Reacts with hot metals Transportation: such as aluminum and magnesium. Çategory Fire..... Ignition Temperature; Not flammable Not flammable.
POISONOUS GASES ARE PRODUCED WHEN HEATED.
West gogged, self-contained breathing oppositute, and rubber overcitining including govers, with water. 0 Electrical Hazard: Not pertinent Health Burning Rate: Not flammable 6.10 Adiabatic Fiame Temperature; Vapor Irritant.... Data Not Available Fire 6.11 Stoichiometric Air to Fuel Ratio: Poisons..... Water Polution Date Not Available Human Toxicity. 6.12 Flame Temperature: Data Not Available CALL FOR MEDICAL 4ID. 7. CHEMICAL REACTIVITY Reactivity Other Chemicals VAPOR
POISONOUS IF INHALED.
Imitating to eyes, nose and throat.
Move to tresh sir.
It bestores has an ones and 7.1 Reactivity With Water: No reaction Water...... 0 7.2 Reactivity with Common Materials: No Sett Reaction...... 0 reaction It breathing has six poed give artificial respiration it breathing is officult, give oxygen. 11.3 NFPA Hazard Classification: Stability During Transport: Stable Classification 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent LIQUID
POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. Flammability (Red)...... 0 7.5 Polymerization: Not pertinent Inheling to shin and eyes.

Remove contaminated country and shoes.

Flush affected area with plenty of water.

If in EVES, not eyelds oper and flush with plenty of water.

If with EVES and eyelds oper and flush with plenty of water.

If with EVES and eyelds oper and flush with plenty of water. Exposure Reactivity (Yellow) 0 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data Not Available 7.8 Reactivity Group: 36 12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Liquid Molecular Weight: 167.85 Water 12.2 North local health and witchie officials. Northy operators of hearby water intakes Bolling Point at 1 atm: 12.3 Pollution 268'F = 131'C = 404'K 12.4 Freezing Point: 49.6°F = 9.8°C = 283.0°K 1. RESPONSE TO DISCHARGE 8. WATER POLLUTION 2. LABEL 12.5 Critical Temperature: Not pertinent 2.1 Category: None (See Response Methods Handbook) 8.1 Aquatic Toxicity: Critical Pressure: Not pertinent 2.2 Class: Not pertinent 16 mg/I/48 hr/bluegill/fresh water 12.7 Specific Gravity: Should be removed Waterlowi Toxicity: Data not available 2,180 at 20°C (liquid) Chemical and physical treatment 8.3 Biological Oxygen Demand (BOD); Data not available 38.75 dynes/cm = 0.03875 N/m at ood Chain Concentration Potential: None 12.9 Liquid Water Interfacial Tension: 36.54 dynes/cm = 0.03654 N/m at 3. CHEMICAL DESIGNATIONS 4. OBSERVABLE CHARACTERISTICS 20°C 12,10 Vapor (Gas) Specific Gravity: 3.1 CG Compatibility Class: Halogenated 4.1 Physical State (as shipped): Liquid Color: Coloriess Not pertinent hydrocarbon 3.2 Formula: BrCH, CH, BI 4.3 Odor: Mildly sweet; like chloroform 12.11 Ratio of Specific Heats of Vapor (Gas): 3.3 IMO/UN Designation: 6.1/1605 3.4 DOT ID No.: 1605 12.12 Latent Heat of Vaporization: 62.1 Btu/tb = 45.6 cal/g = 3.5 CAS Registry No.: 106-93-4 1.91 X 10° J/kg 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 5. HEALTH HAZARDS 9. SHIPPING INFORMATION 12.15 Heat of Solution: Not pertinent 5.1 Personal Protective Equipment: Canister type mask or self-contained air mask; neoprene gloves; 9.1 Grades of Purity: Commercial 12.16 Heat of Polymerization: Not pertinent chemical safety popples. Storage Temperature: Ambient 12.25 Heat of Fusion: 13.79 cal/g Symptoms Following Exposure: Local inflammation, blisters and ulcers on skin; irritation in lungs 9.3 Inert Atmosphere: No requirement 12.26 Limiting Value: Data Not Available and organic injury to liver and kidneys; may be absorbed through skin 9.4 Venting: Pressure-vacuum 12.27 Reid Vapor Pressure: 0.4 psia Treatment of Exposure: Remove from exposure, Remove contaminated clothing. Wash skin with soap and water. Flush eyes with plenty of water. Consult physician. Threshold Limit Value: 2 ppm Short Term Inhelation Limits: 50 ppm for 5 min. Toxicity by Ingestion: Grade 3; LDso = 50 to 500 mg/kg Late Toxicity: Data not available Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect if temporary.

Liquid or Solid Irritant Characteristics: Minimum hazard, If spilled on clothing and allowed to remain, may cause smarting and recidening of the skin.

Odor Threshold: Data not available 5.11 IDLH Value: 400 ppm NOTES

TETRAETHYL LEAD

Common Synonyi TEL Lead tetraethyl	Common Synonyms City liquid Colorless, but Fruity odor generally dyed red Sinks in water. Poisonous, flammable vapor is produced.		6.1 6.2 6.3	fire HAZARDS Flash Point: 200°F C.C.; 185°F O.C. Flammable Umits in Air: Data not available Fire Extinguishing Agenta: Water, foam, dry chemical, or carbon dioxide	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X-Y		
Wear googles, (inclui Stop discharge Call fire depar Stay upwind a Isolate and rei	ding gloves). e il possible.	ratus, and rubber overclothing down" vapor.	6.5 6.6	Fire Extinguishing Agents Not to be Used: Not pertinent Special Hazards of Combustion Products: Toxic gases are generated in fires. Behavior in Fire: May explode in fires.	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Poison, B 11.2 NAS HAZARD Rating for Bulk Water Transportation: NOt Ested 11.3 NFPA Histard Classification:		
Fire	Combat fires from behind bar Flood discharge area with wa	ite, in an enclosed area, breathing sparatus, and rubber overclothing mer or protected location, liter, emical, foam, or carbon dioxide.	6.7 6.8 6.9 6.10	Ignition Temperature: Decomposes above 230°F Electrical Hazard: Not pertinent Burning Rate: Data not available Adiabatic Flame Temperature: Data not available (Continued)	Category Classification Health Hazard (Blue)		
Exposure	Will burn eyes. Remove contaminated cictivity affected areas with pie IF IN EYES, hold eyelids open IS SWALLOWED and water	e anticial respitation. tygen. ED OR IF SKIN IS EXPOSED, ng and shoes. Inty of water. In and flush with plenty of water. Is CONSCIOUS, have within drink water is CONSCIOUS, have within drink water is UNCONSCIOUS OR HAVING CONVULSIONS.	7.2 7.3 7.4 7.5 7.6 7.7	7. CHEMICAL REACTIVITY Reactivity With Water: No reaction Reactivity with Common Materials: Rust and some metals cause decomposition. Stability During Transport: Stable below 230°F. At higher temperatures, may detonate or explode when confined, Neutralizing Agents for Acids and Caustica: Not pertinent Polymerization: Not pertinent Inhibitor of Polymerization: Not pertinent Molar Ratio (Reactant to Product): Date not available Reactivity Group: Date not available	12. PHYSICAL AND CHEMICAL PROPERTIES		
Water Pollution	HARMFUL TO AQUATIC LIF May be dangerous if it enter Notity local health and windst Notity operators of hearby wi	e chicials.			12.1 Physical State at 15°C and 1 atm:		
(See Response I Issue warning water cor Restrict acces Should be ren Chemical and 3. CHEMIC 5.1 CG Compatibility 3.2 Formular PDICsH 3.3 IMO/UN Designs 3.4 DOT ID Noz 1641	1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-poison, water contaminant Restrict access Should be removed Chemical and physical treatment 3. CHEMICAL DESIGNATIONS 3.1 CG Competibility Class: Not listed 3.2 Formula: PD(C+16)4 3.3 IMO/UN Designation: 5.1/1649 3.4 DOT ID No.: 1649 3.5 CAS Registry No.: 78-00-2		8.2 8.3	8. WATER POLLUTION Aquatic Toxicity: 0.20 mg/l/96 hr/bluegiil/TL _m /fresh water Waterfowl Toxicity: Data not available Blological Oxygen Demand (BOD): Data not available Food Chain Concentration Potential: Data not available	12.5 Critical Temperature: Not perinent 12.6 Critical Pressure: Not perinent 12.7 Specific Gravity: 1.633 at 20°C (liquid) 12.8 Liquid Surface Tension: 26.5 dynes/cm = 0.0265 N/m at (est.) 25°C 12.9 Liquid Water Interfecial Tension: (est.) '40 dynes/cm = 0.04 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not perinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not perinent 12.12 Latent Heat of Vaporization: Not perinent 12.13 Heat of Combustion: (est.) —7,670 Btu/lb = —4,380 cal/g = —183 X 10° J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not perinent		
type for longe white or light- 5.2 Symptoms Folia from inhalation not confuse w 5.3 Treatment of Elimental state immediately. If petroleum dist 5.4 Threshold Limit 5.5 Short Term Inh 5.6 Toxicity by Ingel 5.7 Late Toxicity: L 5.8 Vapor (Gas) jirr 5.8	rive Equipment: Organic vap r periods; neoprene-coated, lic- bolored dothing; rubber shoes wing Exposure: Increased un n or skin contact, may cause in thi norganic lead. poposure: Remove victim from NGESTION; induce vomiting. Siliste followed by soap and wa Value: 0.1 mg/m² slation Limita: 0.15 mg Pb/m² setton: Oral rat LD ₁₀ ≈ 17 mg sead poisoning	rinary output of lead. If a large degree of absorption normals, excitability, delirium, come and death. Do contaminated area and consult physician SKIN; wash immediately with kerosene or similar ster. 9 for 30 min. /kg cause a slight smarting of the eyes or respiratory	9.2 9.3	9. SHIPPING INFORMATION Grades of Purity: Technical Storage Temperature: Ambient Inert Atmosphere: No requirement Venting: Pressure-vacuum	12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Umiting Value: Data not available 12.27 Reld Vapor Pressure: Data not available		
5.9 Liquid or Solid I	irritant Characteristics: Caus i; máy cause secondary burns i: Data not available	es smarting of the akin and first-degree burns on		Fire HAZA Stoichlometric Air to Fuel Ratio: Data not a Flame Temperature: Data not available	RDS (Continued) vvallable		

TOLUENE

Common Synor	nyms Watery liquid	Coloriess Pleasant odor		6. FIRE HAZARDS	10. HAZARD ASSESSMENT CODE
Taluol Methylbenzene Methylbenzol	enzene enzol Flosts on water. Flammable, irritating vapor is produced.		6.1 6.2 6.3	Flash Point: 40°F C.C.; 55°F O.C. Flammable Limits in Air: 1.27%-7% Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.	(See Hazard Assessment Handbook) A-T-U
Shut off ight Stay upwind Avoid contact Isolate and t	ge if possible. Keep people aw ion sources and call fire depar and use water spay to "knock ct with liquid and vapor, emove discharged material, realth and pollution control age	ment. down" vapor.		Fire Extinguishing Agents Not to be Used: Water may be ineffective Special Hazards of Combustion Producta: Not perinent Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: Éstegory Rating
Fire	FLAMMABLE, Flashback along vapor trail Vapor my explode if ignife Wear goggies and self-cont Extinguish with dry chemical Water may be ineffective on Cool exposed containers with	ined breathing apparetus. , foam, or carbon dioxide. , fire.	6.7 6.8 6.9 6.10	e source of ignition and flash back. Ignition Temperature: 997*F Electrical Hazzard: Class I, Group D Burning Rate: 5.7 mm/min. Adiabatic Flame Temperature: Data not available (Continued)	Fire
Exposure	omicul presining, of the Move to It seah sin. If breathing has stopped, gill breathing officult, give ox LIOUD imitating to skin and eyes. If swellowed, will cause has Permove contaminated cloth Flush affected areas with place to the Cause had been as the place of the place	i, voming, headache, dizziness, so of consciousness. we entirely respiration. yeen. see, vomiting or loss of consciousness. ing and shoes. enty of water. en and flush with prenty of water. is CONSCIOUS, have victim chink water.	7.2 7.3 7.4 7.5 7.6 7.7	7. CHEMICAL REACTIVITY Reactivity With Water. No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not pertinent Polymerization: Not pertinent Inhibitor of Polymerization: Not pertinent Molar Ratio (Reactant to Product): Date not available Reactivity Group: 32	Aesthetic Effect
Water Pollution	Dangerous to aquatic life in Fouling to shoreline. May be dangerous if it ente Notify local health and which hotin operators of nearty w	rs water intakes. de officials,			PHYSICAL AND CHEMICAL PROPERTIES Physical State at 15°C and 1 atm: Licoud Molecular Weight: 92.14 Boiling Point at 1 atm:
(See Response	NSE TO DISCHARGE Methods Handbook) og-high flammability ea	LABEL 2.1 Category: Flammable liquid 2.2 Class: 3	8.2 8.3	8. WATER POLLUTION Aquatic Toxicity: 1180 mg/t/96 hr/sunfish/TL _w /tresh water Waterfowl Toxicity: Data not available Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor), 6 days Food Chain Concentration Potential:	139"F = -95.0"C = 175.2"K 12.5 Crtical Temperature: 605.4"F = 316.6"C = 591.8"K 12.8 Crtical Pressure: 596.1 psis = 40.55 atm = 4.108 MN/m³ 12.7 Specific Gravity: 0.867 at 20"C (liquid) 12.8 Liquid Surface Tension:
3. CHEMI 3.1 CG Compatibili Hydrocarbor 3.2 Formula: CeHi 3.3 IMO/UN Design 3.4 DOT ID No.: 12 3.5 CAS Registry h	n CHa nation: 3.2/1294 94	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as ahipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant		None	28.0 dynes/cm = 0.0290 N/m at 20* 12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25* 12.10 Vapor (Gas) Specific Gravity; Not perinent 12.11 Ratio of Specific Heats of Vapor (Gas) 1.089 12.12 Latent Hast of Vaportzation: 155 Btu/lb = 86.1 cal/g = 5.61 X 10* J/kg
5.2 Symptoms Foheadache, a aspirated, or ingested cau ingested cau water for at water for at 5.5 Short Term in 5.5 Short Term in 5.7 Late Toxicity: 5,8 Vapor (Gas) ir system if pre 5.9 Uquid or Solic	ective Equipment: Air-supplied flowing Exposure: Vapors irritinesthesia, respiratory arrest. Lisuses coughing, pagging, distributes exposure: INHALATION: remot a doctor. INGESTION: do NOT less 15 min, SKIN: wipe off, with Value: 100 ppm for 3 pestion: Grade 2; LDa. e 0.5 Kidney and liver damage may mant Characteristics: Vapors isent in high concentrations. T is Irritant Characteristics: Kidney and liver damage may mant Characteristics: Vapors isent in high concentrations.	ve to tresh air, give artificial respiration and oxygen if induce vomiting; call a doctor. EYES: flush with ash with soap and water. 10 min. to 5 g/kg follow ingestion. cause a slight smarting of the eyes or respiratory be effect is temporary. In mun hazard. If spilled on clothing and allowed to	9,2 9,3	9. SHIPPING INFORMATION Grades of Purity: Research, respent, nitration-all 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 80/120: less pure than industrial. Storage Temperature: Ambient linert Atmosphere: No requirement Venting: Open (flame artester) or pressure-vacuum	3.55 X 10° J/kg 12.13 Heat of Combustion: —17,430 Btu/lb = —9556 cal/g = —405.5 X 10° J/k 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 17.77 cal/g 12.26 Limiting Value: Dat not available 12.27 Reid Vapor Presaure: 1.1 psia
remain, may 5,10 Odor Thresho 5,11 IDLH Value: 2,		oi the skin.		6. FIRE HAZAF Stoichlometric Air to Fuel Retio: Data not at Flame Temperature: Data not available	· · · · · · · · · · · · · · · · · · ·

Common Synon 3-Dimethylbenzene ylol		Colorless Sweet odor Flammable, irritating vapor is produced.			
Avoid contact isolate and re	ge if possible keep people awa enment, and and vapor, embye discharged material, health and pollution control ager				
Fire	FLAMMABLE Flashback along vapor trail of Vapor may explode it ignited wear set-contained breather Enlinguish with floam, only charter may be ineffective or Cool exposed containers with	ng apperetus. hemical, or carbon dioxide. - fire.			
Exposure	consciousness. Move to fresh air. If breathing has stopped, give it breathing is officult, give of LOUID Intrasting to skin and eyes. If swallowed, will cause naus Remove contaminated clothing Flush affected rates with his	to eyes, nose, and throat. J. will cause headache, difficult breathing, or loss of coursess. fresh air. Ing has stopped, one anticult respiration. Ing is officult, give crygen. Ito skin and eyes. Wed, will cause nausea, vomitting, or loss of consciousness. contemnated cooring and shoes. Contemnated cooring and shoes. Est, hold eyelds open and flush with plenty of water LOWED and worth is CONSCIOUS, have wind mink water.			
Water Pollution	HARMFUL TO AQUATIC LIF Fouling to shoveline. May be dangerous if it enten Notify local health and wildlift Notify local health and wildlift Notify local health and wildlift	de othicials.			
(See Response Issue warning Evacuate are Should be re-	NSE TO DISCHARGE Methods Handbook) g-high flemmability	2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3			
3. CHEMIC 3.1 CG Compatibilit Hydrocarbon 3.2 Formula: mc-CH 3.3 IMO/UN Design 3.4 DOT ID No.: 130 3.5 CAS Registry N	1 14(CH2)2 hatton: 3,2/1307 07	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color; Colorless 4.3 Odor; Like benzene; characteristic aromatic			
plastic gloves 5.2 Symptoms Foli- skin, if taken edema, it inje and liver dam 5.3 Treatment of E oxygen it requ flush with wat 5.4 Threshold Limit 5.5 Toxicity by Inje 5.7 Late Toxicity; it 8.8 Vapor (Gas) Irri system it pres 5.9 Liquid or Solid	sctive Equipment Approved as and boots, lowing Exposure: Vapors caus into lungs, causes severe cougested, causes nausea, vomitting nage can occur. Exposure: INHALATION: removupited; call a doctor. INGESTION ter for at least 15 min. SKIN: with Value: 100 pm. halation Limitat; 300 ppm for 30 sestion: Grade 3; LDse = 50 to Kidney and liver damage. Hant Characteristics: Vapors sent in high concentrations. The Irritant Characteristics: Minitrauses smarting and reddening a d; 0.05 ppm.	o 500 g/kg cause a slight smarting of the eyes or respiratory le effect is temporary, mum hazard. If spilled on clothing and allowed to			
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6. FIRE HAZARDS 6.1 Flash Point: 64°F C.C. 7. Flammable Limits in Air. 1.1%-6.4% 6.3 Fire Extinguishing Apenta: Foam, dy chemical, or carbon dioxide 6.4 Fire Extinguishing Apenta Not to be Used: Water may be inetfective. 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 986°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rete: 5.8 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available 7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Apents for Acids and	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U 11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire
Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Moisr Ratio (Reactant to Product): Data not evaliable 7.8 Reactivity Group: 32	Health Hazard (Blue)
	PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm; Liquid 12.2 Molecular Weight: 106.16 12.3 Boiling Point at 1 atm; 268.4°F = 131.9°C = 405.1°K 12.4 Freezing Point:
8. WATER POLLUTION 8.1 Aquatic Toxicity: 22 ppm/96 hi/bluegill/TL _m /fresh water 8.2 Waterfowl Toxicity: Date not available 8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days 8.4 Food Chain Concentration Potential: Date not available	-55.2'F = -47.8'C = 225.3'K 12.5 Critical Temperature: 650.8'F = 345.8'C = 617.0'K 12.6 Critical Pressure; 513.6 atm = 34.95 psis = 3.540 MN/mt 12.7 Specific Gravity; 0.864 at 20'C (liquid) 12.8 Liquid Surface Tembon; 26.6 dynes/cm = 0.0286 N/m at 20'C 12.9 Liquid Water Interfacial Tembon; 36.4 dynes/cm = 0.0364 N/m at 30'C 12.10 Vapor (Gas) Specific Gravity; Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas); 1.071 12.12 Latent Heat of Vaporization; 147 Btu/lb = 61.9 cal/g =
9. SHIPPING INFORMATION 9.1 Grades of Purity: Research: 99,99%; Pure: 99,9%; Technical: 98,2% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum	3.43 x 10° J/kg Heat of Combustion: —17,554 Btu/lb = —9752.4 cal/g = —408.31 X 10° J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 26.01 cal/g 12.26 Limiting Value: Date not available 12.27 Reid Vapor Pressure: 0.34 psia
NO	TES

Diesel Oil (fuel oil #2)

Physical and chemical description: flammable, slightly viscous brown liquid obtained from the distillation of crude petroleum. Diesel oil is a mixture of hydrocarbons, predominately unbranched alkanes of 10-16 carbon atoms with smaller amounts of aromatic and polynuclear aromatic hydrocarbons (PAH's). Diesel oil floats on water, having a specific gravity of less than 1.

Uses: fuel for trucks, ships, and trains.

Toxicity: Because of their water solubility and carcinogenicity, benzene and PAH's are the chemicals of health concern in diesel oil. Benzene, found in trace amounts in diesel oil, is known to cause leukemia, a cancer of the blood forming cells. PAH's as a class (1-10% in diesel) are considered to be carcinogenic to a number of animal species. Benzo(a)pyrene is one of the most commonly found and carcinogenic PAH. The alkanes of 10-16 carbon atoms, which make up the bulk of diesel oil, are of less concern due to their very low water solubility and low toxicity.

Concentration Guidelines and Standards: The maximum tolerable concentration for diesel oil in drinking water is 100 ug/l, due to organoleptic (taste and smell) considerations. The EPA Office of Drinking Water recommends that the short term concentrations of PAH's in drinking water not exceed 25 ug/l. This is the 7 day suggested no adverse response level (SNARL) and does not take into account the long term cancer risk. These concentrations should be tolerated only in emergency situations where no other higher quality water source is available.

Naphthalene (C10Hg)

Physical and Chemical Description: white crystalline solid with a characteristic "moth ball" odor. Naphthalene is more dense than water (sp. gr. 1.145) and has a solubility of 30,000 - 40,000 ug/l @ 25°C. It melts at 80°C but will sublime (volatilize from a solid) at room temperature. Naphthalene is considered a polynuclear aromatic hydrocarbon (PAH).

Uses: intermediate in dye production and formation of solvents, lubricants, and motor fuels. Used directly as a moth repellant.

Toxicity: Naphthalene may be absorbed by inhalation, ingestion or skin or eye contact. Chronic exposure can cause cataracts, kidney disease and red blood cell breakdown, especially in infants and individuals deficient in the enzyme G6PD. Naphthalene has been shown to be nonmutagenic and noncarcinogenic.

Classification: Hazardous Substance (EPA)

Hazardous Waste (EPA)

Priority Toxic Pollutant (EPA)

Persistance: Naphthalene can oxidize in the presence of light and air, 50% after 14 days in one study. Microbial degradation has also been demonstrated in the laboratory in solutions as concentrated as 3.3 ug/1. Little breakdown is expected, however, under the dark, anaerobic conditions characteristic of in-situ ground water.

Phenanthrene (C14H10)

Physical and Chemical Description: colorless, monoclinic crystals soluble in water, 1,000-1,300 ug/1 @ 2.5°C, specific gravity = 1.179. Phenanthrene is a PAH.

Uses: dyes, explosives, a natural constituent of coal tar and of diesel oil (0.35%).

Toxicity: Phenanthrene has been identified as a mild allergen and human dermal photosensitizer. Limited acute and chromic animal experiments show it to be of low to moderate toxicity.

Classification: none

Fluorene (C13H10)

Physical and Chemical Description: Combustible white solid having a density of 1.20 and a water solubility of 1980 ug/l.

Uses: Manufacture of dyestuffs.

Toxicity: Little specific information is available about the toxicity of fluorene but it is a polynuclear aromatic hydrocarbon (PAH), a group which contains known human carcinogens.

Classification: None

5.0 SITE CONTROL

- <u>5.1 ZONATION</u>. The general zonation protocols that should be employed at hazardous waste sites are described in Chapter 8.0 of the CLEAN HASP. The site-specific zonation that will be used for this project is described as follows. The site is not classified as a hazardous waste site and, therefore, no zonation procedures will be used during this project. However, whenever possible, non-intrusive procedures such as paperwork, equipment preparation, etc., will be conducted away from the site.
- <u>5.2 COMMUNICATIONS</u>. When radio communication is not used, the following air horn signals will be employed:

HELP	three short blasts	()		
EVACUATION	three long blasts	()		
ALL CLEAR	alternating long and sh	ort blasts	()

- 5.3 WORK PRACTICES. General work practices to be used during ABB-ES projects are described in Chapter 9.0 of the CLEAN HASP. Work at the site will be conducted according to these established protocol and guidelines for the safety and health of all involved. Specific work practices necessary for this project or those that are of significant concern are described as follows.
- Work and sampling will be conducted in Level D clothing and equipment.

6.0 DECONTAMINATION AND DISPOSAL

- All personnel and/or equipment leaving contaminated areas of the site will be subject to decontamination, which will take place in the contamination reduction zone. General decontamination practices used during ABB-ES projects are described in Chapter 13.0 of the CLEAN HASP.
- <u>6.1 PERSONNEL DECONTAMINATION</u>. The site is not classified as a Hazardous Waste Site, therefore, stringent decontamination practices are not warranted.
- 6.1.1 Small Equipment Decontamination Small equipment will be protected from contamination as much as possible by keeping the equipment covered when at the site and placing the equipment on plastic sheeting, not the ground. Sampling equipment used at the site will be used only once or will be field cleaned between samples with soapy water (Alconox), rinsed with clean water, rinsed with an approved Quality Assurance/Quality Control solvent, and final rinsed with organic free water.
- 6.1.2 Heavy Equipment Decontamination No heavy equipment is planned to be used during this project.
- 6.2 COLLECTION AND DISPOSAL OF DECONTAMINATION PRODUCTS. All disposable protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will be disposed of at the site. Decontamination fluids (i.e., methylhydrate [e.g., split spoons and groundwater sampling pump]) will be stored in amber glass bottles. Disposable materials (e.g., gloves and TyveksTM) will be bagged and disposed of properly.

7.0 EMERGENCY AND CONTINGENCY PLAN

This section identifies emergency and contingency planning that has been undertaken for operations at this site. Most sections of the HASP provide information that would be used under emergency conditions. General emergency planning information is addressed in Chapter 14.0 of the CLEAN HASP. The following subsections present site-specific emergency and contingency planning information.

- 7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS. The site HSO or the Health and Safety designee is the primary authority for directing operations at the site under emergency conditions. All communications both on- and off-site will be directed through the HSO or designee.
- 7.2 EVACUATION. Evacuation procedures at the site will follow those procedures discussed in Chapter 14.5 of the CLEAN HASP for upwind withdrawal, site evacuation, and evacuation of the surrounding area. Evacuation from the DFSP facility will be conducted with all personnel meeting at the main facility gate at the northwest corner of the site. Evacuation will proceed by travelling south (left) on North Rhett Boulevard, away from the site.
- 7.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID. Any personnel injured on-site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

8.0 ADMINISTRATION

8.1 PERSONNEL AUTHORIZED DOWNRANGE. Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Project Manager and the HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must use the buddy system, and check in with the Site Manager and/or HSO before going downrange.

CERTIFIED ABB ENVIRONMENTAL TEAM PERSONNEL:

	+ Ken Busen	<u>+ Joe Daniels</u>
	*+ Peter Redfern	*+ Andrew Harvey
	*+ Jay Koch	*+ Kathleen O'Neil
	+ Alan Stodghill	<u>+ Peggy Layne</u>
	*+ Kevin Warner	
OTHER	CERTIFIED PERSONNEL:	

- * FIRST-AID-TRAINED
- + CPR-TRAINED

8.2 HEALTH AND SAFETY PLAN (HASP) APPROVALS. By their signatures, the undersigned certify that this HASP will be used for the protection of the health and safety of all persons entering this site.

Lenner Buse	4/24/91
Health and Safety Officer	Date
	4/26/91
Project Manager	Date
- Carl Davi	4/20/91
Health and Safety Manager/Supervisor	Date

8.3 FIELD TEAM REVIEW. I have read and reviewed the health and safety information in the HASP. I understand the information and will comply with the requirements of the HASP.

NAME:		 	 	
DATE:		 		
SITE/	PROJECT:			

assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet. Project: Name: Address: Home Telephone: Area Code () Weight: _____ Age: _____ Height: _____ In case of emergency, contact: Address: _____ Telephone: Area Code (___) Do you wear contact lenses? Yes () No () Allergies: List medication(s) taken regularly: Particular sensitivities: _____ Previous/current medical conditions or exposures to hazardous chemicals: Name of Personal Physician: Telephone: Area Code ()

<u>8.4 MEDICAL DATA SHEET</u>. This Medical Data Sheet will be completed by all on-site personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with

This data sheet will accompany any personnel when medical

the CLEAN HASP.

8.5 EMERGENCY TELEPHONE NUMBERS.

Police Department	(803) 747-5711
Primary Hospital (U.S. Naval Hospital	(803) 743-5130
Alternate Hospital (Baker Hospital)	(803) 744-2110
Base Fire Department	(803) 744-4073
Off-site Emergency Services	(803) 744-4073
Poison Control Center	(800) 962-1253
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(800) 414-8802
Site HSO: Alan Stodghill	(904) 656-1293
General Site Supervisor: <u>Ken Busen</u>	(904) 656-1293
Project Manager: <u>Peter Redfern</u>	(904) 656-1293
ABB Environmental HSM: C.E. Sundquist	(207) 775-5401 x101

<u>8.6 ROUTES TO EMERGENCY MEDICAL FACILITIES</u>. The primary source of medical assistance for the site is:

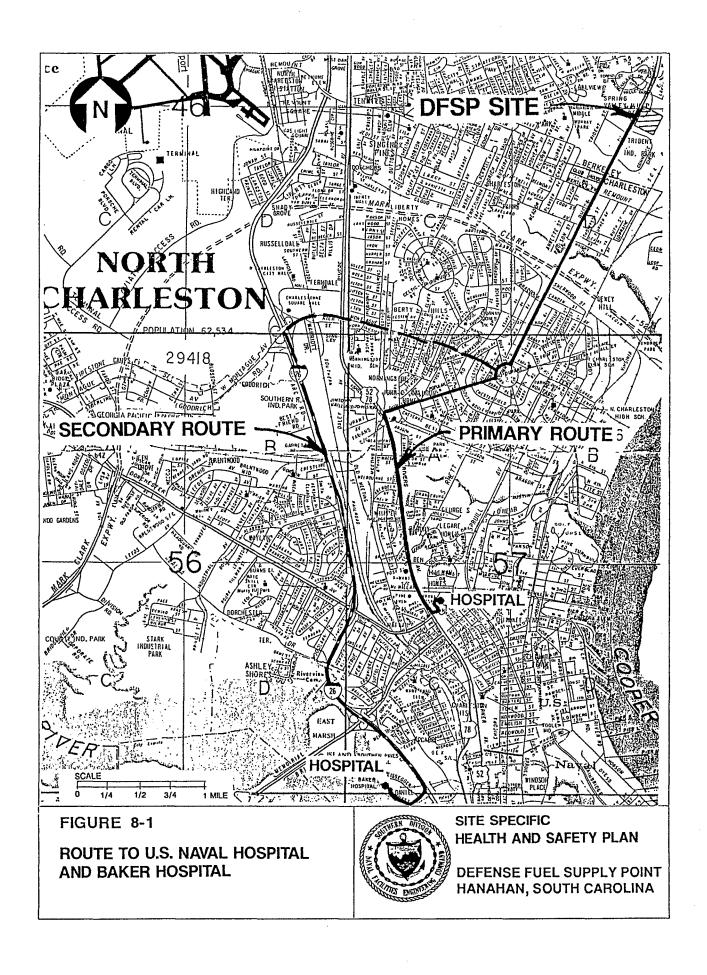
U.S. Naval Hospital Charleston, South Carolina

<u>DIRECTIONS TO PRIMARY</u>: Take Rhett Ave. (Hwy 136) south to Park Circle. Turn right and drive around Circle until you reach Montague Ave. Go west on Montague Ave. until you reach Interstate 26. Take Interstate 26 south approximately 3.5 miles. Hospital is on the right side of the Interstate. See Figure 8-1.

The alternate source of medical assistance for the site is:

Baker Hospital Charleston, South Carolina

<u>DIRECTIONS TO ALTERNATE</u>: Take Rhett Ave. (Hwy. 136) south to Park Circle. Turn right and drive around circle until you reach Durant Ave. Go west on Durant Ave. until you reach Rivers Ave. Take Rivers Ave.south approximately 1.5 miles. Hospital is on the left side of Rivers Ave. See Figure 8-1.



JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm or employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides the employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each nonserious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control emplyee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for health such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. Thee programs are usually administered by the State labor or Health department or a State university.

POSTING INSTRUCTIONS

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

(404) 047 0570
(404) 347-3573
(617) 565-7164
(312) 353-2220
(214) 767-4731
(303) 844-3061
(816) 426-5861
(212) 337-2325
(215) 596-1201
(415) 995-5672
(206) 442-5930

1989 (Revised) OSHA 2203

Washington, D.C.

Elizabeth Dole, Secretary of Labor
U.S. Department of Labor
Occupational Safety and Health Administration

Under provisions of Title 29, Code of Federal Regualtions, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.

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Art.				